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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1363
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1363
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1364
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1368
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1369
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1370
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1371
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1371
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 1372

Note: N.A. means that no abstracts were assigned to this category for this issue.

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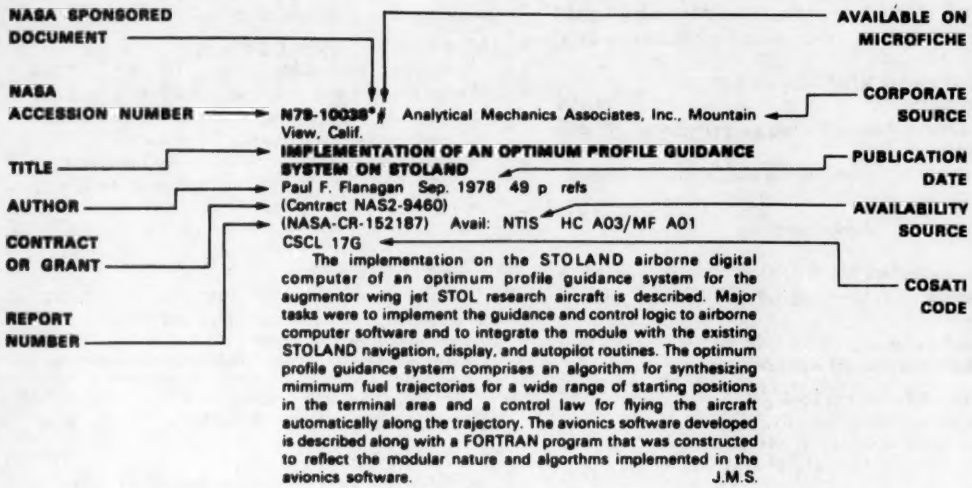
TYPICAL CITATION AND ABSTRACT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N78-10038*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
CORPORATE SOURCE
TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
PUBLICATION DATE
AUTHOR
Paul F. Flanagan Sep. 1978 49 p refs
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorthms implemented in the avionics software.
J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, FILTRATION ELEMENT FOR FLUIDIC AND PNEUMATIC CONTROL AIR SUPPLIES

D.J. Schaffer, Signal Companies Inc., Airesearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DN890123; N00019-78-C-0393)

Conduct a research and development project to investigate and develop design criteria for a pneumatic filtration device.

An investigation of filter requirements will be conducted and design criteria established based upon air pressures, flow rates, temperatures and contaminant levels of aircraft engine bleed air and compressor outputs. Based on this criteria, filtration components will be fabricated and tested for a specific aircraft application.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0002, INTEGRAL FUEL TANK DESIGN HANDBOOK

J.W. Mahoney, Rockwell International Corp., *International Airport, Los Angeles, California* (DF142010; F33615-78-C-3212)

This work unit supports the Air Force's effort to reduce the life-cycle costs of future systems. This is to be accomplished through improved design concepts and material selection for integral fuel tanks. The Air Force has experienced severe fuel leak problems from integral type fuel tanks. These problems have been caused partly by poor design practice and environmental degradation of sealant materials. This situation has resulted in a large number of continuing repairs being required for integral fuel tanks. The objective of this effort is to alleviate this problem through the publication of a design handbook which will document approved design details and materials for sealing integral fuel tanks.

It is felt that the basic data and information required to publish a handbook is available within the industry. Thus the first year's effort will publish a basic design handbook based on already available data. Future year efforts will update the handbook based on the data to be developed from other parallel programs which will develop improved designs and materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, NAVY VEHICLE DESIGN AND CONSTRUCTION - TRANSONIC EXTERNAL STORE INTERFERENCE AND INTEGRATION

N. Malmuth, Rockwell International Corp., Science Center, *2421 W. Hillcrest Ave., Thousand Oaks, California* 91320 (DN875431; N00014-78-C-0477)

The problem of aircraft/external weapons aerodynamic interference is of major importance in the final performance of the aircraft as a weapons platform. This aerodynamic interference becomes even more critical with requirements to carry and release weapons at higher speeds. Historically, the aircraft configuration has been largely fixed before external weapons are added to the platform. This precludes any extensive platform configuration changes to minimize unfavorable aerodynamic interference and usually results in extensive model and flight testing to insure satisfactory aerodynamic integration and perfomance of the system. It is the objective of this project to study interference phenomena associated with aircraft/stores interactions at transonic speeds as a basis for development of simplified computational models for aerodynamic prediction.

The approach to achieve this objective will be to develop simplified semi-analytical/computational concepts to treat the store-pylon-wing interaction problem, correlate the simplified analytical concepts with the full three-dimensional computational model, and parametrically study the influence of pylon height, store size, wing sweep, and Mach number on system aerodynamic interference. In addition new aircraft/weapons integration concepts will be analyzed to investigate the potential for minimizing aerodynamic interference by including this integration at the early conceptual stage of aircraft development.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0004, EVALUATION OF LIME-TREATED NATIVE SOIL FOR BASE COURSES AT AIRPORTS USED BY LIGHT AIRCRAFT

Unknown, U.S. Dept. of Defense, Navy, Civil Engineering Lab., *Port Hueneme, California* 93043 (FA78WAI-834; FA161213 (TRAIS NO.))

The objective of this study is develop criteria for the use of lime stabilization of subgrade material to serve as base course for light duty airport pavements.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0005, ADVANCED PARACHUTE CONTAINER DESIGN

G.R. Drew, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN695423)

(A) To provide fleet ejection seats with parachutes permanently sealed and protected against the operational environment. (B) To eliminate periodic repack cycle and withstand indefinite storage life and 15 years in service on ejection seat. (C) Reduce packaging weight by 30% and volume by 65%. (D) Eliminate 95% of service maintenance requirements. (E) Eliminate in-flight unavailability type malfunctions. (F) Eliminate parachute canopy wear and tear. (G) Reduce parachute system life-cycle cost by 20 to 30%. (H) Increase parachute reliability.

Identify materials and processes to establish feasibility of packaging parachute canopies to provide 100% protection of canopy against the fleet operational environment. Concept includes 'one-time packaging' in factory under 100% quality control. Test units will be manufactured and subjected to environmental, flight, airdrop, and ejection seat testing. Units will be mounted on the back of ejection seats where they will be afforted maximum protection against wear and tampering, and hindrance to deployment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0006, EXTENDED LIFE AEROCONICAL PARACHUTE
G.R. Drew, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN895417)

Establish feasibility of sealed plastic technology/vacuum packaging of the aeroconical parachute canopy for extended service in the operational environment.

Hermetically sealed vacuum/pressure packaging techniques and aerospace plastics will be applied to packaging the new aeroconical parachute. 'One-time' factory packaging with strict quality control will be used to obviate the necessity for repacking. Test units will be manufactured, and subjected to environmental, flight tests and ejections to prove the concept feasible.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0007, RESEARCH ON VARIABLE DENSITY TURBULENCE
P.A. Libby, University of California, San Diego Campus, Graduate School, Dept. of Applied Mechanics, *P.O. Box 109, La Jolla, California* 92037 (NSG 3219)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0008, A SPECIALISTS MEETING ON HELICOPTER ACOUSTICS 15739-E
L.K. Rolfs, American Helicopter Society Inc., *1325 18th St. N.W., Suite 103, Washington, District of Columbia* 20036 (DA0F9159; DAAG29-78-M-0075)

To focus attention on the possibilities and problems of reducing helicopter noise. Relevance - the understanding, prediction and reduction of rotorcraft noise has been and continues to be an area of intense Army interest. This symposium will bring together many of these Army specialists in addition to outside scientists to discuss the current status of research and project future promising research areas for reduction in helicopter noise.

An international symposium planned for 22-24 May at the NASA Langley Research Center will bring together the user, developer-manufacturer, researcher-scientist, and regulating agencies to stimulate new ideas and foster increased communications and interactions between all specialists involved in the rotorcraft acoustic community.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0009, STRAPDOWN TACTICAL INERTIAL GUIDANCE SUBSYSTEM, FLIGHT TEST
L.R. McClintock, Honeywell Inc., *13350 W. South Hwy. 19, St. Petersburg, Florida* 33733 (DF636840; F08635-78-C-0162)

This is an effort to evaluate the in-flight alignment and calibration techniques which are required for the pure inertial guidance of tactical missiles using strapdown inertial measurement systems (spinning mass and laser gyro). These techniques consist of optimal Kalman filter alignment/calibration methods and optimal aircraft transfer alignment maneuvers developed under the UTG study.

This program will consist of the development of the software required to perform the in-flight alignment/calibration of two inertial guidance systems (IGS). This system, consisting of the H-700 ring laser gyro IGS, the H-478 conventional gyro IGS and support equipment, will be mounted aboard a pallet and flight-tested by the Central Inertial Guidance Test Facility (CIGTF) at Holloman AFB. CIGTF personnel will accomplish the flight testing of the H-700/H-478 IGSs and the alignment/calibration software. The flight-test period will last approximately 6 months.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0010, MANAGEMENT OF TURBULENCE AND VORTICITY IN CONTRACTING FLOWS WITH APPLICATIONS TO SIMULATIONS OF FLIGHT FAN NOISE
H.M. Nagib, Illinois Inst. of Technology, Graduate School, Dept. of Mechanics & Mechanical & Aerospace Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (NSG 3220)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0011, FUEL SPRAYS IN HIGH-SPEED AIR FLOWS
J.G. Skifstad, Purdue University, School of Engineering, Dept. of Mechanical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 3213)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0012, GENERAL AVIATION AERODYNAMICS AND DYNAMICS
J.B. Barlow, University of Maryland, College Park Campus, School of Engineering, Dept. of Aerospace Engineering, *College Park, Maryland* 20742 (NSG 1570)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0013, DIGITAL FLIGHT CONTROL SOFTWARE VALIDATION/VERIFICATION METHODOLOGY DEVELOPMENT
E.R. Rang, Honeywell Inc., *2600 Ridgeway Parkway N.E., Minneapolis, Minnesota* 55413 (DF141450; F33615-78-C-3605)

The program is in support of future advanced digital flight control systems of aerospace vehicles. Future flight control systems will be digital and to date no economical, highly effective means exists for proving the correctness of the associated software. Presently, extensive testing and simulation have been used to ensure correctness of the system software design, which is expensive and inadequate for complex systems. This program is intended to provide analytical and automatic techniques to validate software design in the design phase of the development cycle of modern flight control systems. A study of existing validation techniques will be made and the most promising adapted to the design of flight control system software. The result will be a design methodology to validate flight control system software at each phase of the development cycle.

An investigation will be conducted into various software development and checkout methodologies to determine applicability to redundant flight control system software design. A disciplined software validation approach will be defined that incorporates the advantages of the investigated technologies. A methodology will be developed that aids in the design and employs as much automation as possible so as to make maximum use of the thoroughness of computerized checkout.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, DEPARTURE TRENDS FOR CCV AIRCRAFT
W. Bihrle, Bihrle Applied Research Inc., *400 Jericho Tpke., Jericho, New York* 11753 (DF133680; F33615-78-C-3600)

One problem area experienced by aircraft designers is their inability to adequately predict high-angle-of-attack characteristics. The mission to be supported is FG02, Development and Improvement of Flight Control Design Techniques. The objective of this effort is to identify trends in the departure characteristics of statically unstable aircraft at high angles of attack. The proposed effort will contribute to a better understanding of expected departure trends and thus provide knowledge to enhance safety of flight and to permit maximum maneuverability.

The departure characteristics of statically unstable aircraft will be evaluated by use of 6-degree-of-freedom digital computer programs. These characteristics will include the effects of varia-

tions in key stability and control parameters. The influence of flight control system augmentation including control position and rate limits will be evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, DESIGN GUIDELINES & OPTIMUM PROCEDURE SUBSYSTEMS

W. Monsen, Grumman Corp., Grumman Aerospace Corp, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF912180; F30602-78-C-0167)

A need exists for the development of systematic methodologies and procedures for the design of built-in test diagnostic subsystems. Such techniques should take into account the reliability characteristics of each isolatable module, the total proportion of equipment faults that the built-in test subsystem will recognize, the life-cycle costs (production, operating and support) associated with the diagnosis and isolation of each module failure, false alarm characteristics associated with each diagnostic plan and impact on equipment maintainability. All of the above should guide not only the choice of the diagnostic subsystem, but indicate just how the subsystem should be designed. What is needed are optimization tools, and algorithms which can be used during design to aid in forming the most efficient design configuration. Preliminary efforts in this area were pursued in-house and were included in MIL-STD-1591 (Analysis/Synthesis Of On-Aircraft Fault Diagnosis Subsystems).

The approach will involve relating such things as intended depth of BIT diagnosis and isolation, the proportion of total faults that the BIT is capable of detecting and diagnosing, false alarm characteristics and effects, the cost impacts (on life-cycle cost) of the BIT, and developing an optimized approach to the incorporation of BIT in a dependent equipment or system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

1.0016, DEMONSTRATION OF DIVERGENCE AND FLUTTER PREVENTION FOR FORWARD SWEPT WINGS

K. Wilkinson, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF142350; F33615-78-C-3223)

Recent feasibility studies indicate that aircraft with forward swept wings show significant improvements in transonic performance when compared to conventional aircraft. Sweeping conventional metal wings forward decreases aeroelastic divergence speed but by using advanced composite materials and incorporating bending-twist coupling in the design, forward swept wings can be divergence- and flutter-free. The objective of this program is to provide correlation between analytical estimates of flutter and divergence speed and wind tunnel tests. The results of this program will be applied to the design and testing of high-performance aircraft with swept forward wings.

The program consists of four phases. Phase 1 is the design and analysis of scaled models demonstrating prevention of aeroelastic divergence and flutter of forward swept wings. The model will be representative of a flight demonstrator using advanced composite materials. Phase 2 is fabrication of the wind tunnel models. Phase 3 is model testing and data reduction. Phase 4 is correlation of analysis and test results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, SPINE COLLOCATION FOR VISCOUS FLOW OVER AFTER-BODY CONFIGURATIONS

S.G. Rubin, Polytechnic Inst. of New York, Brooklyn Campus, Graduate School, Dept. of Aerospace Engineering, *333 Jay St., Brooklyn, New York* 11201 (NSG 1559)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0018, FORWARD SWEPT WING AEROELASTIC STUDIES

V.C. Sherrer, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142370)

Recent analytical studies have shown that forward swept wings offer the performance advantages of reduced drag and increased maneuverability over aft swept wings. The construction of all-metal forward swept wings was first attempted in the late 1930's, but until recently, designs with large forward sweeps proved to be impractical. This was because prohibitive weight increases in the wing structure were necessary to overcome the static instability known as divergence. Current analyses have shown, however, through the use of aeroelastic tailoring of advanced composite wing skins, the divergence problem can be eliminated without a significant weight penalty. The objective of this work unit is to provide experimental verification of the ability of advanced composites to eliminate divergence in forward swept wings while also satisfying flutter requirements. A secondary objective is to provide the investigators with an increased understanding of the mechanism of divergence and its relationship with advanced composite materials. This study will contribute to the advancement of forward swept wing technology and to possible improved performance of future military aircraft.

Design and analysis studies are first conducted on various forward swept wing configurations. Then an aeroelastic low-speed wind tunnel model configuration is selected and designed using the computer procedures TSO and NASTRAN. The cantilever wing model will be a simple composite plate with a balsa or foam sleeve forming a symmetrical airfoil. The model will be designed to diverge within the low-speed wind tunnel operating regime. If possible, flutter characteristics of forward swept wings will also be experimentally determined. A cable restraint system will be used to prevent model destruction. Low-speed wind-tunnel tests will be conducted with several composite plate designs and other important parameter variations. Experimental results will be compared with analytical predictions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, DESIGN AND ANALYSIS OF CLOSED LOOP GUIDANCE LAWS FOR VTOL AND STOL VEHICLES

G.L. Slater, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NCA 2-130801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0020, MEETING FOR AGARD/NATO REPRESENTATIVES

J. Militello, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAS 3-21698)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0021, A STUDY OF LANDING GEAR DYNAMICS

H.M. Fishman, Franklin Inst. of the State of Pennsylvania, *20th & Benjamin Franklin Pkwy., Philadelphia, Pennsylvania* 19103 (DN881493; N62269-78-C-0016)

To develop and demonstrate a second generation landing gear analysis system. This contract supports work unit ZA601, Aircraft Technology, Agency Accession No DN 6801080.

Needed advances will be identified through survey of industry methodology and practice procedures will be developed to meet these needs.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0022, IDENTIFY AND QUANTIFY RESIDUAL STRESS AND MATERIAL DAMAGE ON ULTRASONIC ATTENUATION-VELOCITY
Unknown, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (NCA 1-17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0023, PRELIMINARY AIRBORNE TESTING OF A G PROTECTIVE SUPINE SYSTEM (PALE)
J. Harding, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881678)

To assess in airborne environments the adequacy of the g protective PALE (pelvis and legs elevating) system which protects aircrew against high in-flight accelerations by transforming gz loads into better tolerable gx loads. This effort is part of the problem area Mechanical Force Environment as listed under priority A code PA J title 'Better Methods To Increase G Tolerance' of the Charleston Report pg 109 1973 (FY74 Naval Aviation Biomedicine Human Effectiveness Report).

A seat system which supports the experimental pilot in the PALE position will be manufactured and integrated in the third pilot station in the cargo compartment of the CH 53. The seat back will be at an angle of 65 degrees from the vertical and will allow for control of rudders and modified stick. Takeoff and landing will be made routinely by the pilot in the cockpit. Once airborne he will relinquish the command for gradually increasing time periods to the experimental (third) pilot provided that flying conditions are smooth and safe. The experimental pilots capability to control the AC in the PALE position will be evaluated. It is understood that the test vehicle is incapable of producing signficant in-flight accelerations. The remarkable g protective qualities of the PALE system, however, have been previously demonstrated in three series of NavAirDevCen centrifuge experiments, thus it is the rationale of this study to show how much (if any) the PALE position affects men's capability to control an aircraft in actual flight. Phase B (not funded at present) in a dual control air vehicle which is capable of producing high in-flight accelerations a PALE seat system of the type used in the beforementioned centrifuge experiments (PALE 15) will be integrated and provided with side arm controls. Similar to Phase A, the experimental pilots performance and safety aspects will be evaluated and compared with previous experiments on the NavAirDevCen centrifuge.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0024, DATA ANALYSIS - ENGINE EMISSIONS
Unknown, U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (FA78WAI-856; FA161222 (TRAIS NO.))

Analyze the emissions data to determine if significant trends with engine operating time exist. Conduct parallel efforts in evaluating emissions data and engine performance characteristics that will then be merged into a single analytical effort as validation of emissions data and engine performance trends are accomplished.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0025, AIR BREATHING ENGINE/TRAJECTORY OPTIMIZATION STUDY
V.K. Smith, University of Tennessee, Knoxville Campus, Graduate School, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS 8-33225)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0026, FINITE ELEMENTS AND NAVIER-STOKES PROBLEMS
G.F. Carey, University of Texas, Austin Campus, School of Engineering, Dept. of Civil Engineering, *200 W. 21st, Austin, Texas* 78712 (NSG 2338)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0027, DEVELOPMENT OF A NONLINEAR VORTEX METHOD
O.A. Kandil, Old Dominion University, Graduate School, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1560)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0028, INVESTIGATION OF AERODYNAMIC CHARACTERISTICS OF WINGS HAVING VORTEX FLOW USING DIFFERENT NUMERICAL CODES
G.L. Goglia, Old Dominion University, School of Engineering, Dept. of Mechanical Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1561)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0029, HT ST 75-30 - IMPACT BEHAVIOR COMPOSITES - ARMY HELICOPTERS
Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3832)

Determine the differences in nonlinear load deflection characteristics between a substructure fabricated with aluminum and the same substructure fabricated with composite materials. The feasibility of applying the analytical and testing techniques used in USAAMRDL TR 74-12 to similar structures fabricated with composites will be investigated.

Phase I - the analytical and testing techniques used in USAAMRDL TR 74-12 will be reviewed. The technical feasibility of performing scale-model tests of the candidate designs will be investigated by analyzing and statically testing and impact testing a one-half scale model of the test specimen of USAAMRDL TR 74-12. Phase II - the Phase I substructure will be redesigned using composite materials. Each of the composite substructure designs will undergo stress analysis, static testing, drop impact testing, and post-test analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0030, DYNAMIC RESPONSE OF COMPOSITE STRUCTURES TO NONNUCLEAR THREATS
J.G. Avery, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF137670; F33615-78-C-3403)

With increased usage of advanced composites as a structural material in aircraft components, the effect of threat-induced damage in a combat environment becomes increasingly important. Aircraft structural designs using composite materials tend to present some unique problems which need to be further explored. The objective of this program is to investigate the effects of nonnuclear threat mechanisms on aircraft structures fabricated from composite materials. As the result of this effort, the effects of threat damage mechanisms on composite structures will be understood and will provide a data base for the development of survivable composite structure design criteria and guides.

To be investigated is the damage that results from the interaction of nonnuclear threat mechanisms with composite structures and the effects that such damage has on the strength of the composite structures. Factors associated with the investigation will be threat types and the damage mechanism associated with each type of threat, various types of composite materials and

structural concepts, the application of the various composite structural concepts, the damage produced by the various threat mechanisms and the effects on the strength of the structural composites produced by the damage. Data voids will be identified and test plans developed to fill these voids.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, CYCLOPHORIA AND PILOT PREDICTION OF THE RUNWAY PLANE
C.L. Kraft, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF051790; F49620-78-C-0052)

AF function - this research provides information necessary to determine the density of textural cues needed in the foreground of flight simulation visual system models to offset residual cyclophoria. Deficiency - runway approaches made at night, in fog, over water or snow-covered ground, provide the pilot with few visual cues by which he can judge his altitude and distance prior to that point where relative motion becomes useful. Likewise in simulator training, in which hardware or software constraints may limit the amount of textural detail in a daylight approach, the size and shape of the runway itself are unreliable cues for the visual assessment of aircraft position relative to the runway. Under these conditions, the pilot's progressive judgment of range and altitude may be derived from his perception of the runway plane. A significant source of error in this perception may be due to 'residual' or 'resting state' cyclophoria, i.e., the wheel-like contrarotations of the eyes about their visual axes. Objective - this investigation will determine the cyclophoria resting state for a sample of AF pilots, and study the effect of this phenomenon on the pilots' perception of the runway plane under various approach conditions. How research contributes - texture specifications for visual system models will be made based upon the outcomes of this research.

A group of 12 AF pilots will be selected on the basis of visual tests so as to provide a stratified sample of residual cyclophoria. Each observer will be given two independent tests of cyclophoria (circle-bar and alternating ramp chromostereopsis tests) and the results will be correlated and used to predict the pilots' perception of the runway plane. A series of computer generated runway representations will be photographed for presentation to the pilots, who will make comparison judgments of the runway plane, i.e., approach angle. The representations will include both day and night scenes of three different runways with several different distances out from runway threshold. The effects of various levels of textural cueing will be correlated with cyclophoria resting state permitting a specification of the minimum type and level of texture required for effective simulation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0032, ADVANCED BRAKE CONTROL SYSTEM
H.H. Straub, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF141220; F33615-78-C-3408)

The level of USAF combat effectiveness depends in part on the capability of its aircraft to land during adverse weather conditions. Assuming that a controlled approach is possible, landing capability is further limited by lack of directional and braking control on the runway. The objective of this effort is to model and analyze an automatic landing control system that will make maximum use of available forces to successfully conclude the landing process once the aircraft has touched down. Such a system will reduce off-runway incidents and extend all-weather landing capability for USAF aircraft.

A government-owned computer program for aircraft landing simulation will be modified to include more sophisticated landing gear and runway models. An automatic control system will also be included in the modified program. Computer simulations will be run to show system effectiveness under adverse conditions. Subsequently, the models will be installed on an AF motion base simulator, which is coupled with existing aircraft hardware, and evaluated against pilot performance. A preliminary design and criteria will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, FIBER-REINFORCED POLYMERIC MATERIALS
R.N. Anderson, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Materials Sciences, *Washington Sq., San Jose, California* 95192 (NSG 2332)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0002, DIRECT OBSERVATIONS OF INTERFACE INSTABILITY DURING CRYSTAL GROWTH
Unknown, Stanford University, Graduate School, *Stanford, California* 94305 (NAS 8-33110)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0003, THE UNDERSTANDING AND EXPLOITATION OF ALLOYS BASED ON TITANIUM AND ALUMINUM
M.J. Blackburn, United Technologies Corp., *400 Main St., East Hartford, Connecticut* 06108 (DF680860; F33615-74-C-1140)

To understand and exploit TiAl intermetallic compounds by investigating phase relationships, alloying behavior and properties of castings.

The research effort will concentrate on two related programs. One effort will focus on the development of crucible and mold materials suitable for TiAl with the objective of growing single crystals or other directionally solidified structures. The second parallel effort will investigate the alloy behavior of the compound TiAl to provide information on crystal chemistry and the influence of chemistry and structures on mechanical properties with emphasis on high temperature creep and low temperature ductility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

3.0004, STUDY OF TEKTITES AND OTHER SPACE RELATED GLASSES
A.M. Thorpe, Howard University, Graduate School, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAS 5-25185)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0005, SURFACE ALLOYING OF BEARING AND GEAR STEELS BY ION IMPLANTATION
J.K. Hirvonon, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN889788)

To improve bearing and gear corrosion resistance and reliability through surface alloying by ion implantation.

By the use of corrosion testing, electrochemical potential measurements and bearing and gear simulated bench testing, ion species and concentrations will be optimized on currently used m50 bearing steel. After optimization, full-scale bearing life testing, engine testing and field evaluation testing will be conducted. A parallel effort will be conducted on implanting advanced bearing and gear materials for corrosion resistance followed by specimen and full-scale testing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0006, MICROBIAL DETERIORATION OF SYNTHETIC FUELS
R.A. Neihof, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880092)

To assess the susceptibility of jet fuels derived from oil shale, tar sands and coal to infestation and deterioration by microorganisms. to identify fuel constituents contributing to microbial growth promotion and to examine ways of preventing such growth.

Test units will be set up containing two phases - a synthetic fuel and a fresh or sea water medium. Bacteria, fungi and yeast known to be prevalent in fuel tanks will be used for inoculation. The test systems will be monitored during a period of a year or more to determine microbial activity and changes in the chemical and physical properties of the fuels. The appearance of any unusual microbial growth stimulation will be traced to the fuel constituents responsible.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0007, ANALYSIS OF SOLID-PROPELLANT FIRE ENVIRONMENT

E.W. Price, Georgia Inst. of Technology, School of Engineering, Dept. of Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF192720; F29601-78-C-0054)

To more clearly define the solid-propellant fire environment associated with launches of nuclear material for use in space power systems with possible applications to the design of materials to be used in future systems.

Perform combustion experiments using UTP 3001 solid propellant to determine the characteristics of the combustion zone including the smoke plume. This will include modeling of the burn rate, characterization of the thermodynamics and heat transfer in the combustion zone, analysis of the aluminum and aluminum oxide interactions, and temperature measurements of the combustion zone.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

3.0008, IMPROVED REACTION SINTERED CERAMICS FOR ENGINES

D.R. Messier, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4699)

The use of ceramic components in engines inevitably involves compromises between factors such as ease of fabrication and low cost vs. optimum corrosion, erosion, mechanical and thermal properties. The objective of this program is to develop improved, economical ceramic materials for future Army power generation and propulsion applications. Although this work is specifically related to the use of ceramic components in the MERADCOM 10 kw turboalternator, it also relates to pacing materials problems in aircraft (turbine components - 14.2, 15.2, 15.7, 15.11 in FY76 guidance), armored vehicles (combustor, power turbine, and regeneration for 1,370 degrees C TIT), and problems in surface mobility and craft and missile materials. The major thrust is cost reduction via fuel economy.

Although reaction sintered silicon nitride is attractive as an inexpensive, fabricable material for use in the nozzle and combustion chamber sections of the 10 kw turboalternator, its resistance to erosion and oxidation appears inadequate for such use. A coating technique that was investigated in a preliminary manner in a previous investigation appears promising for overcoming these deficiencies. Certain alloying additions such as titanium appear effective in promoting wetting of porous silicon nitride by silicon, thus allowing the formation of uniform metallic coatings on that material. These coatings may be used as is, or further nitrided to produce nitride coatings on silicon nitride. During the fiscal year, the coating process will be perfected, and the erosion, corrosion and mechanical properties of the coated materials will be determined also to be considered are other candidate materials such as sintered silicon carbide or silicon carbide composites.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0009, CRASH-IMPACT FIRE OF FIBER-REINFORCED COMPOSITES

G.S. Springer, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Mechanical Engineering, *Ann Arbor, Michigan* 48104 (NSG 2333)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0010, ELECTROCHEMICAL SEPARATIONS FOR OBTAINING METALS AND OXYGEN FROM LUNAR SAMPLES

L.A. Haskin, Washington University, Graduate School, *Brookings 220, St. Louis, Missouri* 63130 (NSG 9073)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0011, AN INVESTIGATION OF THE PHOTOCHEMISTRY OF THE ATMOSPHERES OF JUPITER AND TITAN

T.C. Owen, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (NCA 2-760901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0012, INVESTIGATION OF INITIATION STAGE OF HOT CORROSION IN NU-BASE ALLOYS

G.H. Meier, University of Pittsburgh, School of Engineering, Dept. of Metallurgical & Materials Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (NSG 3214)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0013, MEASUREMENT OF HIGH-TEMPERATURE PROPERTIES OF LIQUID AND SOLID TUNGSTEN

J. Margrave, Rice University, Graduate School, Dept. of Chemistry, *6100 Main St., Houston, Texas* 77001 (NAS 8-33199)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0014, THE HIGH REYNOLDS NUMBER FREE SHEAR LAYER (BEHIND A BACKWARD FACING STEP)

A.K. Hussain, University of Houston, School of Engineering, Dept. of Mechanical Engineering, *3801 Cullen Blvd., Houston, Texas* 77004 (NSG 2337)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0015, MANUFACTURE OF DPFC-DMS POLYMER IN THE SKG RANGE AND STUDY

B.M. Hughes, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Materials Science & Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NAS 2-10064)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0016, TRIBOSTIMULATED EXOEMISSION FROM OXIDE COVERED METALS

R.F. Braunlich, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DF052890; AFOSR-78-3650)

AF function - future high-performance aircraft will employ an increasing amount of adhesively bonded structures. Deficiency

- in order to obtain maximum strength, metal components are anodized to form a thin oxidized layer and the adhesive is then used to bond these layers together. The mechanical strength and other properties of the anodized oxide must be determined in order to insure compatability and strength in the bonded region. Objective - the objective of this research is to examine the fracture dynamics and micromechanics of thin, anodized oxide films on metals by measuring the tribo-emission of charged particles during early stages of microcracking. How work contributes - analysis of the emitted particles will provide greater understanding and optimization of the oxide films grown on metals prior to adhesive bonding.

Tribo-emission of electrons, negative and positive ions and photons will be measured as a function of stress, strain, and fabrication variables. The micro imperfections, chemical and mechanical, will be characterized to develop a better understanding of the mechanism of tribostimulated exoemission. The characteristic exoemission curves (CEC) will be used to develop a testing method for quality control of oxides applied to aircraft sheet metal for the purpose of adhesive bonding.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, PRE-COOPERATIVE ENGINEERING EDUCATION PROGRAM

U.H. Sams, Tuskegee Inst., Graduate School, *Tuskegee Institute*, *Alabama* 36088 (NGT 01-005-780)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0002, ELECTRONIC COMPONENTS FOR A/C PROPULSION CONTROLS

R.F. Potter, (No Performing Organization Reported), San Diego 92106, *California* (DN890085; N00019-78-M-0285)

A research study to examine and evaluate the impact future propulsion system controls will have on electronic components and constituent solid-state materials.

Major aircraft engine companies will be contacted by the investigator to assist him in assessing electronic control needs for future high-temperature jet engines.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0003, ION IMPLANTATION AND LASER ANNEALING IN SEMICONDUCTORS AND RELATED MATERIALS

J.F. Gibbons, Stanford University, School of Engineering, Dept. of Engineering, *Stanford*, *California* 94305 (DMR78-19970)

This research will be a study of the effects of laser annealing on removing damage induced in semiconductors by ion implantation. The objective will be to determine the mechanism whereby this occurs, particularly in view of the fact that the annealing does not result in any change in the ion implanted concentration profile. The research will include both experimental and theoretical studies of the recrystallization mechanisms of ion implanted silicon using both pulsed and continuous wave laser annealing.

Work will be initiated to apply the laser annealing technique to other semiconductor systems and metal oxides where thermal annealing is known to produce self-compensation of the implanted species. Another task will involve application of laser annealing to recrystallization of superconducting intermetallic compounds. Although fundamental in nature, the results of this work could have a significant impact on the electronics industry.

This grant continues studies initiated under NSF Grant DMR76-18000, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

4.0004, A PROGRAM OF RESEARCH AND RESEARCH INTERNSHIPS IN TELECOMMUNICATIONS AND INFORMATION TECHNOLOGY

J.F. McAlister, Stanford University, School of Engineering, Dept. of Engineering Economic Systems, *Stanford*, *California* 94305 (NASW 3204)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0005, ACOUSTIC MICROSCOPY FOR NONDESTRUCTIVE EVALUATION OF MATERIALS

C.F. Quate, Stanford University, School of Engineering, Dept. of Electrical Engin, *Stanford*, *California* 94305 (DF053080; F49620-78-C-0098)

AF function - the maintenance and quality assurance of flight vehicles rely heavily on nondestructive evaluation (NDE) of critical metallic components. Deficiency - there is a deficiency in techniques to specify size, shape, and orientation of flaws in structural materials which initiate catastrophic failure. Objective - the objective of this research is to develop acoustic imaging techniques and to establish the role of acoustic microscopy in NDE for structural materials. How work contributes - this research will provide an instrument and techniques for its use in NDE for structural materials.

Scanning acoustic microscopes, the underlying theory of their operation and data analysis will be perfected for the NDE of binary alloys and other compounds, microcracks, strains, adhesions, and corrosion and anodic films.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, DIGITAL FILTERS AND INTEGRAL APPROXIMATION THEORY

L.O. Ferguson, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Applied Science, *Riverside*, *California* 92502 (DF052230; AFOSR-78-3599)

AF function - to advance the design of cost-effective digital filters for radar, telemetry, and communications systems. Deficiency -the advantages of digital signal processing are so compelling that the AF as well as commercial communications companies is gradually converting all communications to digital systems. The applications, however, still contain some technological and economic problems that prevent the widespread usage of digital methods. Objective - to advance the theory of approximation of rational functions with rational or integer coefficients in order to effectively design realizable filters that closely approximate a desired ideal performance. How work contributes - success in this research could lead to vastly improved digital circuitry for the various electronic systems used in aerospace vehicles and communications networks.

The plan is to apply where possible the results on approximation by polynomials and rational functions with integral coefficients to the present problem of approximating a desired transfer function by rational functions with quantized coefficients, and to extend these results where necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, A STUDY OF POULTRY PLANT NOISE CHARACTERISTICS AND POTENTIAL NOISE CONTROL TECHNIQUES

R.A. Cassonova, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W.*, *Atlanta*, *Georgia* 30332 (NSG 3228)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0008, FLAT PLATE PHOTOVOLTAIC SYSTEM COSTS STUDY
R.P. Zimmer, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DEN 3 73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0009, VARIABLE-RATE UNIVERSAL SOURCE CODING
M.B. Pursley, University of Illinois, Urbana Champaign Campus, School of Engineering, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (ENG75-20864)

This research is concerned with universal source coding subject to a fidelity constraint as well as universal noiseless coding. In both of these source-coding situations, variable-rate codes are superior to fixed-rate codes. However, most of the previous research in universal source coding with a fidelity criterion has been concerned with fixed-rate coding only. The investigators have demonstrated the existence of one type of universal code (weighted universal) for source coding subject to a fidelity constraint. The existence of a stronger, more useful type of universal code (Minimax Universal) is an open problem for coding subject to a fidelity constraint but it is clear that such a code must have a variable rate. Variable-rate universal source codes are ideally suited for such applications as storage of satellite weather photographs and other image data on magnetic tape or in a computer memory, transmission of data in computer-communication networks, or communication and data transmission over variable-rate channels. For applications like these, optimal variable-rate codes minimize the amount of tape or memory needed for data storage, the required transmission time for a packet of computer data, or the required transmission rate over a variable-rate channel.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0010, TECHNIQUES FOR GENERATING UNSTEADY AIRFOIL FLOWS
W.J. Cook, Iowa State University of Science & Technology, School of Engineering, Dept. of Mechanical Engineering, *496 Town Engineering Bldg., Ames, Iowa* 50011 (NCA 2-340901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0011, SIMULATION OF MARTIAN AEOLIAN PHENOMENA
J.D. Iversen, Iowa State University of Science & Technology, School of Engineering, Dept. of Aerospace Engineering, *496 Town Engineering Bldg., Ames, Iowa* 50011 (NCA 2-340802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0012, CORRELATION OF AXIAL-FLOW COMPRESSOR AND FAN CASCADE DEVIATION ANGLES BY ANALYSIS OF BLADE SURFACE BOUNDARY LAYER CHARACTERISTICS
G.K. Serovy, Iowa State University of Science & Technology, School of Engineering, Dept. of Mech Engin, *496 Town Engineering Bldg., Ames, Iowa* 50011 (DF052340; AFOSR-78-3609)

AF function - advanced turbomachinery. Opportunity - improved understanding of flow through an axial flow turbojet engine. Objective - development of a deviation angle prediction method for advanced compressor and fan cascade configurations. How work contributes - would provide better flow angle distribution and losses for use in design and performance predictive methods for advanced axial flow compressors. This will result in better engine designs.

Experimental data for compressor cascade deviation angle will be obtained, reviewed and processed as required for quantitative comparison. Computed values based on a recently developed prediction system will be obtained for similar test case sets. The combined computed and experimental test case sets will then be used as a basis for an attempt to modify the presently used method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, QUASI-OPTICAL TECHNIQUES FOR MILLIMETER AND SUBMILLIMETER-WAVE CIRCUITS 15465-EL
T. Itoh, University of Kentucky, Graduate School, *Limestone & Euclid, Lexington, Kentucky* 40506 (DA0F9077; DAAG29-77-G-0220)

To investigate both theoretically and experimentally a class of dielectric transmission lines suitable for millimeter and submillimeter wave components and integrated circuits. Relevance - results of the study are directly relevant to Army systems requiring low-cost, reproducible millimeter wave components. Reviewers from MIRADCOM and ECOM mention applications to missile sensors and terminal guidance, radar for mini-remotely piloted vehicles and communications.

To utilize surface wave propagation guided on the interface between a dielectric slab and a dielectric strip as a building block for millimeter wave integrated circuits. Particular emphasis will be placed on the utilization of grating structures within the guiding region to obtain (1) leaky-wave antennas and (2) high-q band-pass and band-reject filters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0014, WORK REQUIRED BY THE FAA ON EXPLOSIVE TESTS
Unknown, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Labs., *Aberdeen Proving Ground, Maryland* 21005 (FA78NA-AP-7; FA161247 (TRAIS NO.))

Provide technical expertise and advice on the proper placement of test equipment and transducers and on the proper acquisition of blast pressure data in explosive tests. Provide personnel to be on-site (NAFEC) for the initial explosive test in January, 1978. Provide data reduction services, transforming the raw data into useable blast pressure versus time curves. Data will be taken from approximately ten (10) pressure transducers in each of the five (5) explosive tests.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0015, COMPUTER SIMULATION OF PROJECTILE/PAYLOAD INTERACTION
W.H. Mermagen, U.S. Dept. of Defense, Army, Armament Research & Development Command, Launch & Flight Div., *Aberdeen Proving Ground, Maryland* 21005 (DA0R4441)

Formulate a computer model and simulation method with graphical display of the dynamic behavior of a projectile acted on by aerodynamic forces and internal payload motion.

Develop deterministic equations of motion for the projectile and empirical/deterministic equations for the payload and adapt for rapid numerical integration. Adapt and use existing model for many-body collisions. Implement software for graphics display. Perform parametric analysis of influence coefficients using the simulator and find optimum coefficients for many-body collision model.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Labs.

4.0016, DESIGN OF FLIGHT CONTROL SYSTEMS VIA ROBUST SERVOMECHANISM THEORY
S.H. Wang, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NSG 1558)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0017, BROADBAND COMMUNICATIONS SATELLITE STUDY GROUP
D.H. Staelin, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAS 5-25091)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0018, AIR FRAME MODULATED SIGNATURES
A. Sangupta, University of Michigan, Ann Arbor Campus, Graduate School, *Rackham Bldg., Ann Arbor, Michigan* 48104 (DF903120; F19628-77-C-0232)

AF function - this effort is related to advanced radar detection and identification capabilities. Deficiency - it is directed at the problem of identifying aircraft by their radar signatures under operational conditions. The objective of the research is to obtain unique airframe-oscillation frequency patterns and corresponding radar signal modulations. How research contributes - deriving characteristic frequency patterns of aircraft structure motions and specifying those patterns which remain relatively invariant over a wide range of operational conditions will allow radar identification of tactical aircraft by examining the modulation patterns imposed on scattered radar signals by the characteristic airframe frequencies.

Aerodynamic forces drive various airframe structural elements at rates which depend on the aircraft configurational characteristics. The research program will determine induced frequency patterns in the motion of these elements under a range of conditions of aircraft loading, stores and operational modes. This data will be examined and analyzed to determine any relatively invariant patterns which would be characteristic of a given aircraft. These patterns will then be further considered to try to ascertain appropriate radar detection techniques based on observing radar signal modulations related to the airframe frequencies. Finally, the problems associated with such detection will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0019, DYNAMICS EXPLORER POWER SUBSYSTEM STUDY
T.G. Wilson, Duke University, School of Engineering, Dept. of Electrical Engineering, *Durham, North Carolina* 27706 (NAS 5-25351)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0020, CONTROL OF A HYBRID SYSTEM WITH FLYWHEEL ENERGY STORAGE AND CONTINUOUSLY VARIABLE TRANSMISSION
J.H. Burghart, Cleveland State University, School of Engineering, Dept. of Electrical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NSG 3223)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0021, INVESTIGATION OF POWER AND ENERGY MEASURING DEVICES FOR MONITORING NON-SINUSOIDAL AC AND PULSED DC SIGNALS
J.F. Maisel, Cleveland State University, School of Engineering, Dept. of Electrical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NSG 3222)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0022, STABILITY AND DYNAMICS OF ELASTIC STRUCTURES AND FLUID FLOWS
E.L. Reiss, Miami University, Graduate School, *Oxford, Ohio* 45056 (DF053290; AFOSR-78-3663)

AF function - to design stable aerospace structures. Opportunity -a new mathematical approach to buckling in the presence of imperfections and to secondary buckling. Objective - aircraft structural design techniques are almost entirely based on linear elastic models. Present aircraft, however, operate in the nonlinear elastic regime with portions of the structure buckled or wrinkled. Improved nonlinear design techniques are being sought. How work contributes - original techniques for predicting catastrophic and secondary buckling and flutter.

Asymptotic techniques of stretching and matching yield non singular equations which extend bifurcation theory. This extended theory will be explored in the contexts of buckling with imperfections, secondary buckling, and nonlinear dynamic stability. Possible directions of research include extension of the theory to the more imperfection sensitive bifurcation points of high multiplicity, periodic and quasi periodic fluid structure interaction such as aircraft panel flutter, a statistical theory of bifurcation permitting direct determination of statistics, forced oscillation of nonlinear systems, and laminar flow transition to turbulence or chaos. Work on wave propagation in thin elastic structures, and nonlinear wave motion in air will be explored also by asymptotic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, PRE-COOPERATIVE ENGINEERING EDUCATION PROGRAM
J. Stranges, Ohio State University, Columbus Campus, Graduate School, *190 N. Oval Dr., Columbus, Ohio* 43210 (NGT 36-008-780)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0024, INVESTIGATION OF COHERENT STRUCTURE IN THE TURBULENT BOUNDARY LAYER
D.E. Abbott, Lehigh University, Graduate School, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DF052500; F49620-78-C-0071)

AF function - advanced aerospace vehicles. Opportunity - provide better understanding of the structure of turbulent boundary layer flows. Objective - to disclose the three dimensional details of the convected coherent structures of turbulent boundary layers and to develop new flow models for improved predictive methods. How work contributes - new and improved prediction methods for turbulent boundary layer flows are needed by designers of advanced aerospace vehicles. This effort is directly related to providing this information.

Flow visualization of wall boundary layer flows in a water channel using transverse and vertical hydrogen bubble wires will be observed in a convected frame of reference. Video presentations of the flows will be made using orthogonal views of the structure of the turbulence or detailed views of a portion of the boundary layer while simultaneously viewing the entire layer. Quantitative data of the turbulence will be obtained through digitization of the video data and by hot-film measurement. The effects of surface roughness, transpiration and suction will be investigated. Interactive theoretical studies will be conducted to provide analytical expression and theoretical basis for the observed phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, A STUDY OF FLOW AND LOSS PROCESSES AT THE ENDS OF A LINEAR THETA PINCH
T.M. York, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802

Purpose: investigate the physics of end loss from a theta pinch including mechanisms governing the loss and methods of inhibiting loss to improve confinement. Approach: Construct a 50 cm pinch apparatus with a 10 cm discharge coil. Measure the loss rate of plasma within the pinch coil, and correlate measurements with properties (pressure, density and temperature) near and at ends; test the theoretical models of end loss with experiments for collisional and collisionless plasmas, with and without magnetic mirrors. (ERDA 77-66)

SUPPORTED BY U.S. Dept. of Energy, Div. of Magnetic Fusion Energy

4.0026, USE OF WAGNER FUNCTIONS IN AIRFOIL DESIGN OPTIMIZATION

V. Sahai, State University & Community College System of Tennessee, Tennessee Technological Unviversity, School of Engineering, Dept. of Engineering SC & Mech, *P.O. Box 128A, Cookeville, Tennessee* 38501 (DF051560; AFOSR-78-3543)

AF function - advanced aerospace vehicles. Opportunity -improvement of numerical methods used in the design of optimized wing sections. Objective - test the suitability of using a mathematical description of airfoil contours based on Wagner functions in a constrained airfoil design optimization computer code. How work contributes - will determine the potential usefulness of a particular functional representation for airfoil geometry applied in a numerical optimization procedure. The advantage of the functional representation in this application is the promise of generating a wide class of shapes in terms of a small number of parameters.

The properties of the Wagner functions will be examined in terms of their ability to generate a wide class of airfoil shapes. Their behavior and relationship to trailing edge slope, nose shape, and other airfoil characteristics will also be studied. The proposed functional relationship will be used in a vanderPlaats-Hicks-type numerical optimization code to design a symmetrical airfoil.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, PARAMETRIC STUDY OF POTENTIAL EARLY COMMERCIAL POWER PLANTS (MHD)

J.B. Dicks, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Physics, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NSG 3224)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0028, THERMODYNAMIC ANALYSIS OF ELECTRON LASER STORAGE

W.B. Coleson, Rice University, Graduate School, *6100 Main St., Houston, Texas* 77001 (NSG 7490)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0029, CONCEPTUAL DESIGN OF A FLIGHT OPERATIONS PLANNING SCHEDULING SYSTEM

W.B. Lee, University of Houston, School of Business Admin., Dept. of Production & Logistics Management, *3801 Cullen Blvd., Houston, Texas* 77004 (NAS 9-15680)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0030, COMPUTATIONAL METHODS IN NONLINEAR MECHANICS

J.T. Oden, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engin & Engin Mech, *200 W. 21st, Austin, Texas* 78712 (DF052690; F49620-78-C-0083)

AF function - design of future lightweight aerospace vehicles will require an improved knowledge of failure modes and nonlinear behavior in order to achieve a high degree of reliability. Opportunity - new analysis methods which accurately predict nonlinear failure mechanics will have a major impact on future vehicle designs. Objective - to develop new solution methods, convergence criteria and error estimates to nonlinear elasticity problems of the following classes, 1) large deformations, 2) stress singularities, and 3) interface contact. How work contributes - results of this research contribute to the improvement of AF structural analysis methods and methodologies.

For the classes of problems listed in the objective above, several different methods of formulation may be needed to achieve acceptable numerical techniques. It is planned to investigate the use of variational inequalities, penalty methods, Lagrange-multipliers and regularization methods. In order to assess the reliability of these methods for each of the problem classes the development of a priori error estimates will be undertaken. This study will lead to criteria of element trial functions which will guarantee convergence. Finally, the methods will be implemented through computational solutions to verify the accuracy and convergence of the procedures as well as additional special features.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, ELECTRONICALLY COMPUTATED D.C. MOTOR FOR ELECTRIC PASSENGER VEHICLES

N.A. Demerdash, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Electrical Engineering, *Blacksburg, Virginia* 24061 (DEN 3 65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0032, DEVELOPMENT OF AN IMPROVED GROUND VIBRATION TESTING AND ANALYSIS METHOD FOR COMPLEX AEROSPACE SYSTEMS

R.F. Michalak, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF140030; F33615-77-C-3059)

Ground vibration tests on current and new weapons systems require an excessive amount of time and cost. The general objective of this program is to develop and demonstrate an optimal, practical, and economical ground vibration test and analysis procedure for use in complex aerospace systems to determine by measurement their dynamic characteristics. The procedure developed shall be one which can be used for testing a wide variety of Air Force flight vehicles in both laboratory and field environments. The dynamic characteristics shall be of sufficient quality and in acceptable form for use in checking analytically predicted data in final flutter and other aeroelastic analyses. The specific objectives of this program are to markedly decrease the time and cost for ground vibration test (GVT), and to obtain additional dynamic characteristic data from test information.

The program will be conducted by a contractor using a team with expertise in the flutter and structural dynamics fields. To accomplish the above objective, the program will be divided into phases consisting of method selection, development, demonstration, application and reporting.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0033, INVESTIGATION OF MODELLING CONCEPTS FOR PLUME AFTERBODY FLOW INTERACTIONS

S.E. Nyberg, Aeronautical Research Inst., *Box 11021, Bromma, Sweden* (DA0D9390; DAERO 78 G0028)

The technical objective of the research effort is to experimentally verify the validity of the theoretical plume-afterbody flow field interaction modeling methodology developed by Korst.

Experimental results form wind-tunnel tests with jet plume flow simulated with cold air and with heated freon will be compared. The experiments will include studies of plume shape effects on base pressure, separation position and pressure distribution on conical and cylindrical afterbodies. Parameters which will be varied are free stream and jet Mach numbers, afterbody cone angle, angle of attack and jet to free stream pressure ratio.

SUPPORTED BY U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, AURORAL AND HIGH LATITUDE IONOSPHERIC MORPHOLOGY AND DYNAMICS
S. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DF582490; F19628-76-C-0074)

AF function - transpolar communications, radar and navigation. Deficiency - the polar ionosphere is typically so disturbed that the above functions are frequently degraded. Objective - investigate the phenomenology of the arctic ionosphere. How research contributes -provides inputs to in-house effort for modelling effects of particle precipitation on arctic ionosphere. This contractual effort is for the investigation of auroral and magnetic phenomena through the collection of data, and analysis of data so as to provide a framework for the interpretation of data collected by AFCRL Airborne Ionospheric Observatory, NKC-135 aircraft, number 53131 and the AFCRL Goose Bay Ionospheric Observatory. The contract also provides for the interpretation of data in terms of magnetospheric substorm theory.

Process and maintain aircraft and ground station all-sky camera data. Gather and interpret ionospheric and magnetospheric data for selected periods in support of special studies. Investigate ionospheric response during a magnetospheric substorm. Clarify relationship between discrete aurora and continuous aurora using DMSP data. Study auroral arc brightenings and interplanetary magnetic field changes as a predictor of substorm onset.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0002, JOINT DEVELOPMENT OF A PLANETARY GEOLOGY CURRICULUM GUIDE
R. Greeley, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NCA 2-35802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0003, ULTRA-MICROSTRUCTURE OF PARTICLES ABRADED UNDER SIMULATED MARTIAN AEOLIAN CONDITIONS
D. Krinsley, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NCA 2-35901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0004, SPECTROSCOPIC OBSERVATIONS OF COMETS
S. Martineck, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (NCA 5-93)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0005, RESEARCH IN ATMOSPHERIC CHEMISTRY AND TRANSPORT
Y.L. Yung, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Science, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 5301)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0006, REMOTE MEASUREMENT OF CROP MOISTURE STRESS UTILIZING THE STRESS DEGREE DAY CONCEPT
J.L. Hatfield, University of California, Davis Campus, School of Agriculture & Environmental Sciences, Dept. of Land Air & Water Resources, *Davis, California* 95616 (NCA 2-180901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0007, CONFERENCE OF USERS OF GEO-BASED DATA SYSTEMS TO EXAMINE GEO-BASED INFORMATION SYSTEM IMPACTS
Unknown, University of California, Santa Barbara Campus, Graduate School, *Santa Barbara, California* 93106 (NASW 3118)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0008, HURRICANE GROUP
R.C. Sheets, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs., *Boulder, Colorado* 80302 (8G121332)

PROJECT OBJECTIVE: To produce the necessary information for use in designing, conducting and evaluating hurricane modification experiments -primarily using conventional aircraft and satellite data.

CURRENT YEAR PLAN: Continue development of physical and statistical evaluations techniques for analysis of experimental and background data.

Document cloud populations and their natural variability within the hurricane. Document the cloud particle state and potential seeding levels in hurricane clouds. Investigate the boundary layer structure in the high wind speed portion of the hurricane. Investigate the effects of the hurricane on the sea surface temperature and thermocline. Conduct one hurricane seeding experiment if opportunity arises.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0009, AIRCRAFT TURBULENCE MEASUREMENTS IN SUPPORT OF STATE EXPERIMENTS
B. Bean, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs., Weather Modification Program Office, Boundary Layer Dynamics Group, *Boulder, Colorado* 80302 (D7-0305; G603A-AA-30)

Turbulence data will be collected during the STATE (Sulfur Transport and Transformation in the Environment) study of instrumented aircraft for the purpose of characterizing the turbulent scales, fluxes, and intensities within the planetary boundary layer as functions of macro-scale meteorological conditions and related surface energy fluxes. These experiments are designed to provide information required to improve our ability to model flow in non-uniform terrain conditions.

A fixed wing aircraft will be equipped with an initial navigation system and fast response wind, moisture and temperature instrumentation. Experiments are planned to coordinate flights with measurement of transport and dispersion from an elevated source as well as with other boundary layer data collected from concurrent tower and tetroon data.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0010, BALLOON-BORNE SPECTROMETER MEASUREMENTS OF UV-VISIBLE SOLAR LIMB EXTINCTION
D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (NSG 1557)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0011, COASTAL UPWELLING ECOSYSTEMS ANALYSIS (CUEA) - METEOROLOGICAL SUPPORT AND INVESTIGATIONS FOR THE JOINT-II EXPEDITION (CUEA COMPONENT 27)

D.W. Stuart, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (OCE77-27735)

Coastal upwelling ecosystems are distinct oceanic entities which occur along the coastal west coasts at low to mid-latitudes. Their uniqueness lies in the highly nutrient-rich water, large communities of plants and animals, and the magnitude of physical processes which occur in the upwelling areas compared to ocean conditions.

The research components of the CUEA Upwelling Ecosystems Analysis project have been designed to coordinate and integrate the physical, chemical and biological oceanographic efforts of the investigators, to obtain a more complete understanding of the various processes occuring in an upwelling regime. The overriding program goal is the utilization of this information to determine methods for forecasting the onset, intensity and extent of this phenomenon and thus predict its response far enough in advance to be useful in managing, preserving and wisely exploiting the vast protein resource of the upwelling regimes.

This CUEA component documented and is analyzing the meteorological conditions at the surface and up to 2,000 meters over the study region. Coordination of coastal and surface buoy data and NCAR aircraft was the responsibility of the principal investigator.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0012, EVALUATION OF REMOTE SENSING TECHNIQUES

L.G. Arvanitis, State University System of Florida, University of Florida, Inst. for Food & Agricultural Sciences, *Gainesville, Florida* 32611 (NAS10-9466)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0013, COLOR INFRARED APPLICATIONS TO CITRICULTURE

C.H. Blasquez, State University System of Florida, University of Florida, School of Agriculture, Dept. of Plant Pathology, *Gainesville, Florida* 32601 (NAS10-9471)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0014, SHIPBOARD TECHNICIAN SUPPORT

J. Gibbons, University of Miami, Dorothy H. & Lewis Rosenstiel School of Marine & Atmosp. Sc., *4600 Rickenbacker Cswy., Miami, Florida* 33149 (OCE77-26357)

This grant will provide partial support for the activities of the Marine Electronics Group at University of Miami's Rosenstiel School of Marine and Atmospheric Research. Principal activities supported by the grant include the maintenance of complex shipboard electronic gear essential to research sponsored by the National Science Foundation as well as integration and utilization of computerized data collection and satellite communication systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0015, AN INVESTIGATION OF THE MINERALOGY AND PETROLOGY OF METEORITE PARENT BODIES UTILIZING REFLECTANCE SPECTROSCOPY

M.J. Gaffey, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (NSG 7462)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0016, WETLAND SOILS AND DRAINAGE MAPPING USING AIRBORNE SENSING TECHNIQUES

Breault, General Electric Co., *5030 Herzel Pl., Beltsville, Maryland* 20705 (FH-11-9271; FH160983 (TRAIS NO.))

Objectives of study are to demonstrate and document the cost-effectiveness of using remote sensing methodology to map wetlands engineering soils data.

SUPPORTED BY U.S. Dept. of Transportation, Federal Highway Admin.

5.0017, FLIGHT TEST OF AIRBORNE DOPPLER WEATHER RADAR

Unknown, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., *Silver Spring, Maryland* 20910 (FAA-RD-450-055; FA161201 (TRAIS NO.))

The purpose of this agreement is to provide for the flight test of an airborne Doppler weather radar in a thunderstorm environment. This radar has been fabricated for use in hurricane studies but should serve to show the utility of airborne Doppler. The flight tests are to be conducted in the vicinity of Oklahoma City so that ground-based Doppler data will be available for comparison. A Doppler weather radar will be developed and installed in a WP-3 hurricane hunter aircraft. This 3cm radar has been designed to measure water droplet motion in hurricanes but will serve as well for droplet motion in thunderstorms.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

5.0018, WIND AND TURBULENCE MEASUREMENTS AND THEORETICAL APPLICATION

Unknown, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF580500; F19628-78-C-0171)

AF function - low-altitude operational satellites and ballistic nuclear weapon delivery. Deficiency - trajectory of missiles and satellites cannot be precisely calculated. Research - utilization of measured turbulent transport parameters in model atmospheres. How research contributes - permits more accurate calculations of dynamic model atmospheres. The results can be used to predict missile reentry and satellite orbit calculations.

The upper atmospheric turbulent motions will be determined from the fine detailed wind measurements (with a discrimination length of approximately 50 m) by the use of a Richardson number filter. These determined values of turbulent kinetic energy will then allow us to accurately estimate the rate of turbulent dissipation in the chemical release trail, spectral analysis permits us to determine directly the turbulent rate of dissipation, from which the turbulent diffusion coefficients may be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, DATA ANALYSIS FOR DEVELOPMENT OF NEW MODEL ATMOSPHERES

L.G. Jacchia, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (DF581700; F19628-78-C-0126)

AF function - orbital navigation, orbital surveillance. Deficiency - ephemerides of operational satellites cannot be computed accurately due to lack of knowledge of spatial and time variations of density at critical altitudes. Objective - participation in the analysis of thermospheric data and the development of new, improved models of the neutral upper atmosphere. How research contributes - new models, which will include work done on this contract, can be recommended for use by COESA in the development of revised U.S. standard supplements and by the NORAD Cheyenne Mountain Space Computation Center for ephemeris computations.

Analysis of satellite, rocket, and ground-based measurements of atmospheric properties will be utilized in the development of new model atmospheres. AE and S3 satellite accelerometer data and coordinated composition data will be used in the development of a model representing neutral atmosphere variations related to geomagnetic activity in the lower thermosphere. A wide range of satellite data and other correlative data will be analyzed

and evaluated for the determination of atmospheric properties as part of the development of dynamic models of the structure of the upper atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, INTERTIDAL ALGAL ANALYSIS - R.U. 428
F.C. Polcyn, University of Michigan, Ann Arbor Campus, Willow Run Labs., *Ann Arbor, Michigan* 48104 (161 (NOAA/EAO NO.))

BACKGROUND: In June 1976, a set of multispectral data was collected by aircraft over three test sites in the Gulf of Alaska. A first analysis of the data showed feasibility for using spectral signature analysis for mapping the intertidal algal communities along the Alaskan coastline. Mission was performed in cooperation with Dr. Zimmerman, the NOAA Auke Bay Laboratories who made ground observations of the test sites. If a cost-effective method for inventorying algal communities along a wider area of the coastline could be developed, then a better environmental impact analysis of critical coastlines could be made relative to requests for exploration leases and development. The objective of this program is to complete the analysis of the data set collected in 1976 by using all known ground truth at the three test sites. Specifically, the tasks would be to: 1. Classify by computer techniques the intertidal algal communities for Latouche, Zaikof Bay, and Cape Yakataga test sites, using the multispectral data stored on magnetic tape and ground truth provided by NOAA. 2. Construct maps of the test site showing by color coding, the geographical distribution of the algal communities specified by Dr. Zimmerman or his NOAA designate. 3. Test classification accuracies of algal classes for other conditions referenced in data set by altitude, scan rate or flight direction for at least one test area. 4. Prepare recommendations for cost-effective operational approach to intertidal algal survey using remote sensing techniques for designated coastlines in Alaska.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0021, AIRCRAFT MEASUREMENTS OF PLUME DISPERSION AND CHEMISTRY
W.M. Vaughan, Environmental Measurements Inc., *8506 Delmar Blvd., University City, Missouri* 63124 (68-02-2709; G625B-EA-36)

To acquire the data base necessary for the development of control strategies for the reduction of ambient air concentrations of sulfates and nitrates, the Environmental Sciences Research Laboratory, EPA will conduct a large-scale program of discrete, intensive experimental field studies during the years FY 78-81; the proposed field studies are identified by the acronym STATE (Sulfur Transport and Transformation in the Environment). Air quality simulation models are the expected end product.

In support of the summer '78 field studies the contractor will supply two moving laboratory platforms for studying plume transport and transformation from the Cumberland Power Plant in Tennessee. One platform will be an instrumented aircraft and the other will be an instrumented automobile - Air Quality Moving Laboratory (AQML) - for surface measurements in the downwind plume.

The aircraft will sample and/or measure SO2, SO4 (continuous and integrated), NO, NO2, NH4, SF6 (continuous), and hydrocarbons over a 4-week period involving approximately 100 flight hours. The AQML will be equipped with a navigational, data acquisition system for controlling the digital recording of data and mapping out the vehicle's sampling route. Sampling and measurements will be made for SO2 at the surface, SO2 aloft by remote sensor (COSPEC), SF6 (continuous) and hydrocarbons.

In addition the contractor will perform GC analysis for detailed trace hydrocarbons (2-C10), selected halocarbons, and sulfur hexafluoride (SF6) in grab samples collected by Sandia Laboratories and EMI.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0022, DEVELOP LASER FLUOROSENSORS FOR MONITORING SURFACE WATERS (ORGANIC CARBON)
M. Bristow, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., Remote Monitoring Methods Br, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J620A-57)

OBJECTIVE/APPROACH: The ultimate objective of this program is to develop an active airborne monitoring system capable of providing quantitative data on the concentration of total organics in surface waters. The principle employed is an extension of the laboratory technique of spectrofluorometry. A water sample is irradiated with ultraviolet (UV) light of a specific wavelength and intensity, and the resultant fluorescence emission is then monitored using a monochromator-multichannel detector combination. The fluorescence signal arises from dissolved organic materials both man-made and natural in origin rather than from the water itself, which does not fluoresce. However, the water molecule emits a Raman band which, for very dilute aqueous solutions of organics, has a constant amplitude for a given intensity of excitation radiation. This water Raman emission band is then conveniently employed as a built-in reference source with which to compare the amplitude of information concerning the concentration of the dissolved organics.

FINAL OUTPUT: Results will be described in EPA report. Developed airborne hardware will be available to EPA, Federal and State Agencies for applications.

RESULTS TO DATE: A firm correlation has been established between dissolved organic carbon (DOC) and normalized fluorescence measurements made on a large number of field samples. Plans are being made to build airborne laser-fluorosensor based on this principle.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0023, DEVELOPMENT OF ENVIRONMENTAL KEYS
V. Webb, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., Environmental Photographic Interpretation Center, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J620A-38)

OBJECTIVE/APPROACH: The objective of this program is to develop aerial photography environmental keys to serve both as a training material for new EPA personnel, or an analysis aid for the experienced photo-interpreter. Development of these keys is a continuous and integral part of remote sensing programs conducted by EPA, using imagery collected for various technical support studies.

FINAL OUTPUT: Publications of the key description documents, serving other interpreters or analysts in the conduct of environmental assessment conducted through the use of aerial imagery.

RESULTS TO DATE: Two imagery interpretation keys are nearly complete, one dealing with detection of landfill leaching contamination and the other deals with potential pollution sources in a typical harbor. In addition, work has begun in several areas of the country to determine where aerial imagery can be used to detect septic tank leach field failures.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0024, THE DYNAMICS OF SMALL CUMULI
J.W. Telford, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (ATM76-23361 A01)

This proposal describes the recent development in cumulus cloud dynamics arising from the author's work with airborne measurements of air motion near cumulus clouds. The departures from the previous models are discussed in detail and the conceptual basis of the new ideas are laid out for consideration. Theoretical work using concepts derived from the interpretation of past measurements seems to offer the best interpretation of the facts known to date. The role of air motion measurements in several crucial tests are discussed and it is proposed that such

measurements can be made with available equipment. The proposal offers the use of the airborne measurement equipment developed at the Desert Research Institute (DRI), using the Litton LN15D inertial platform and the DRI aircraft, to obtain the necessary measurement data.

If this theory is confirmed it will offer a major new insight into the dynamics of small cumuli.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0025, THE FORMATION, MAINTENANCE, AND CLIMATIC EFFECTS OF WEST COAST SEA STRATUS

J.W. Telford, University of Nevada, System Office, Desert Research Inst., Atmospheric Sciences Center, *Reno, Nevada* 89507 (ATM77-16321)

The objective of this research is to use an instrumented aircraft to gather cloud microphysical properties and radiative fluxes of stratus clouds so as to examine in detail the latest models and thinking related to the formation and persistence of ocean stratus and fog.

Special emphasis will be made on the role of radiation and cloud top mixing processes on the development and persistence of these clouds.

During the initial stages of this program, the efforts will be primarily to install, calibrate, and test the performance of cloud physics and radiation instruments aboard the DRI research aircraft.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0026, MEASUREMENTS OF ELECTRICAL CONDITIONS IN THUNDERCLOUDS

W.P. Winn, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (ATM78-09710)

The objectives of this research are to measure the electrical conditions within thunderclouds and to relate them to precipitation. The electrical conditions will be measured using balloons and aircraft. The equipment used in these studies have been improved from previous experience.

In this research, the first year will be spent on the testing of the various instruments for measuring electric field. The demonstration of using an instrumented aircraft will add a new dimension for data collection within a thundercloud.

During the second year, the emphasis will be on the participation of TRIP 79 to be held at Socorro, New Mexico. This group will host the cooperative effort of the international thunderstorm program.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0027, BALLOON-BORNE COSMIC RAY LABORATORY PROGRAM

R.L. Golden, New Mexico State University, Las Cruces Campus, Graduate School, *University Park, Las Cruces, New Mexico* 88003 (NAS 9-15660)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0028, EXTENDED SCENE RADAR CALIBRATION SUPPORT

K. Carver, New Mexico State University, Las Cruces Campus, School of Engineering, Dept. of Electrical Engineering, *University Park, Las Cruces, New Mexico* 88003 (NAS 9-95486)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0029, INTERPRETATION OF SATELLITE IMAGERY BY COMPUTER-QUANTITATIVE METHODS

P.R. Baumann, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (SER78-00001)

The objective of this proposed project is to develop a computer software system and related instructional materials that will provide undergraduate students the opportunity to learn how to interpret satellite imagery by using computer and quantitative techniques. Fourteen times a day both of NASA's Landsat satellites orbit the earth collecting land use and resource information from the earth's surface. Together, these satellites are able to scan any area of the globe, except the poles, every nine days. As living space in the United States and the world continues to shrink rapidly, land use and resource planning becomes more and more vital. Americans are being faced now and will continue to be faced for many years to come with the problem of how to use best their finite space and resources. To make informed decisions, up-to-date land use and resource information becomes vital. To employ this new technology for the purpose of acquiring information needed to make meaningful decisions about the use of our land and resources, it is necessary to make people aware of its capabilities and potential and to train people to use it, which represents the overall goal of this proposed project.

A course is to be developed which will provide students with experience in interpreting satellite imagery in the digital form by using computer and quantitative techniques. This approach has both economic and accuracy advantages over the almost universal photographic interpretation.

SUPPORTED BY U.S. National Science Foundation, Div. of Science Education Resources Improvement

5.0030, RADIOACTIVITY IN STRATOSPHERIC AIR

E.P. Hardy, U.S. Dept. of Energy, Health & Safety Lab., *376 Hudson St., New York, New York* 10014 (000530)

This program is comprised of two separate projects: the High Altitude Balloon Sampling Program and Project Airstream involving aircraft sampling. The balloon program provides samples from 20 to 27 km at 65 degrees N, 33 degrees N and 9 degrees N several times a year. The aircraft sampling extends from 75 degrees N to 10 degrees S in the western hemisphere and ranges in altitude from 12 to 19 km. At least three aircraft missions are flown per year. The filters are analyzed for long-lived fission products, plutonium isotopes and radon daughter products. The fission product data reflect the patterns of recent atmospheric nuclear weapons testing. The plutonium mass isotopic composition aids in characterizing the stratospheric debris. Lead and polonium-210 in the stratosphere are natural tracers of tropospheric origin and are useful in assessing the extent of stratosphere-troposphere interchange.

SUPPORTED BY U.S. Dept. of Energy, Health & Safety Lab.

5.0031, TRANSITION ZONE VEGETATION BETWEEN INTERTIDAL MARSH AND UPLAND IN OREGON AND WASHINGTON

R.E. Frenkel, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Geography, *126 Agricultural Hall, Corvallis, Oregon* 97331 (R804963-01; M608C-208)

OBJECTIVES: To determine the pattern of vegetation in the transition zone between intertidal marsh and upland vegetation in Oregon and Washington with the ultimate goal of providing substantive data upon which guidelines for the specification of coastal wetlands may be based.

APPROACH: Approximately 15 marshes in coastal estuaries and the Puget Sound will be selected based on a classification and criteria developed in the project. Selected marshes will be sampled floristically using line transects in order to determine marsh zonation patterns. The transition zone will be characterized by floristic analysis including, but not limited to, ordination and Braun-Blanquet tabular analysis. Vegetation criteria for defining the upper and lower boundaries of the transition zone will be developed and will be validated by application to other intertidal marshes in Oregon and Washington. Selected environmental

measures will be taken including salinity and substrate texture. Coordination with the National Ocean Survey, providing leveling to datums, and with the Environmental Protection Agency Remote Sensing program will extend the value of this research.

CURRENT PLANS/PROGRESS: Pilot research in defining upper limit of marsh in four Oregon intertidal marshes is underway. Proposed research will take 18 months and involve the principal investigator and three assistants.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Research Lab.

5.0032, SOME DYNAMIC AND RADIATIVE EFFECTS OF THE SAHARAN AIR LAYER - A CONCLUSION

T.N. Carlson, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (ATM76-14518 A01)

The objective of this research is to complete a project that studied the effect on the atmosphere of Saharan dust outbreaks during the GARP Atlantic Tropical Experiment (GATE). The first and completed phase of this project was devoted to an analysis of solar radiation and aerosol measurements, a determination of the radiative properties of the aerosol, and a description of the large scale aerosol mass loading during several Saharan dust outbreaks using satellite visible brightness measurements. In this final phase the net (solar and infrared) aerosol heating rates will be estimated. The balanced vertical motions will be computed, both with and without radiative forcing, from large-scale wind analyses for three case studies in order to describe the effects of the Saharan air layer and dust on the overall dynamics of the tropical atmosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0033, DIGITAL LANDSAT DATA ANALYSIS OF TENNESSEE

F. Shahrokhi, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS 8-33218)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0034, LINEAR AND NONLINEAR INTERACTIONS OF THE LARGE-SCALE ATMOSPHERIC WAVES

S.K. Kao, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NAS 5-25373)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0035, WATER RESOURCES DIVISION SATELLITE DATA RELAY PROJECT

R.W. Paulson, U.S. Dept. of the Interior, Geological Survey, Water Resources Division, *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (WD 70-111)

There is a rapidly developing satellite data collection system technology that may provide the Water Resources Division with new and economical means for collecting remote site water-resources data. Recent tests of the LANDSAT Data Collection System have demonstrated the feasibility of mating USGS field instruments with field radios, and routinely relaying the data. The Geostationary Operational Environmental Satellite Data Collection System holds promise as an operational tool, but is yet untested with WRD instruments and applications.

The objectives are to test, and evaluate the performance characteristics of the LANDSAT, GOES and subsequently available satellite Data Collection Systems as potential operational WRD tools.

A number of LANDSAT-DCS experiments have been conducted and will continue. The GOES-DCS will be tested in FY 76. This project will have overall responsibility for the program of testing these systems. The program will consist of technical coordination and direction from the project leader in Reston, computer software support being developed in the ADP Section in Reston and a subordinate project, headquartered in the Gulf Coast Hydroscience Center, which will provide general software support and test receive-site technology. The support project is 'Water Resources Division Satellite Data Relay Equipment Support Project' (SR75-052).

LANDSAT DCP's are being operated by 25 WRD Districts, and Reston computer files and programs permit WRD users to retrieve data in engineering from LANDSAT-DCP's. In effect the LANDSAT DCS is almost operational for WRD users. Procurement of LANDSAT/GOES DCP's has begun with delivery to begin in July 1975. Liaison has been established with WRD Districts to test the GOES-DCS in FY 1976.

LANDSAT DCS activities by Districts will continue to receive support from this project. Primary emphasis will be on testing the GOES-DCS. An integration of the GOES-DCS with the Survey's network of field instrument and the Survey's telecomputing network will permit a simulation of an operational data collection and processing system.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0036, STUDIES OF EXTRATROPICAL CYCLONIC STORMS (THE CYCLES PROJECT)

P.V. Hobbs, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (ATM77-01344)

The objective of this research is the observation and interpretation of meteorological events on the synoptic, mesoscale, and cloud microphysical scale. These observations will be obtained using aircraft, Doppler radars, radiosonde ascents, and a special surface network of observing stations. These data will, it is hoped, extend and confirm previous observations revealing the mesoscale features of rainbands accompanying cyclonic disturbances in the Pacific Northwest and the apparent ineffectiveness of the Bergeron-Findiesen process in producing natural rainfall.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0037, MEASUREMENT OF TROPOSPHERIC AND STRATOSPHERIC TRACE GASES BY GAS CHROMATOGRAPHY

D.R. Cronn, Washington State University, School of Engineering, Dept. of Chemical Engin, *Pullman, Washington* 99163 (R804033-03; G603A-AI-04)

The objective is to make measurements of the vertical concentration distributions of selected trace gas species in the troposphere and lower stratosphere. Emphasis will be placed on determinations of halocarbons and non-methane hydrocarbons. Determination of the concentrations of the halocarbon species will be accomplished by the methods of electron capture - gas chromatography and gas chromatography-mass spectrometry -while gas chromatography with flame ionization detection will be employed for the determination of the hydrocarbons. Samples will be collected by aircraft flights in the United States.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0038, TO INVESTIGATE DATA USE AND DATA PROCESSING PRACTICE OF AGENCIES OR FIRMS IN THE PACIFIC NORTHWEST

G. Petterson, Western Washington State College, Huxley College of Environmental Studies, *Bellingham, Washington* 98225 (NCA 2-862801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0039, THE KINEMATICS OF THUNDERSTORM GUST FRONTS RELATING TO THE MITIGATION OF AIRPORT FLIGHT HAZARDS

A.H. Auer, University of Wyoming, School of Engineering, Dept. of Atmospheric Science, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (ATM76-14520 A01)

The objectives of this study are to observe and measure the characteristics of thunderstorm gust fronts and other strong wind shear phenomena, analyze the data and synthesize the results, relate the findings to low level aircraft operation including both landings and takeoffs, and disseminate this information to potential users, including the commercial airlines, general aviation, aircraft designers, Federal, state and local government units, and airport managers and operators.

Because of the lack of suitable weather, no data were collected in the St. Louis area in 1976 as originally anticipated. However, suitable weather occurred in the Northeast Colorado and Wyoming areas in 1977, and data were obtained on four days. Because of the delay in obtaining the data and the fact that the data quality and quantity obtained exceeded original expectations, an extension in time and supplemental funding is necessary to complete the analysis of the data, synthesis of results and dissemination of the findings and recommendations.

This is a supplement to ATM76-14520.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0040, ATMOSPHERIC CLOUD PHYSICS LABORATORY ICE FORMING EXPERIMENT PRELIMINARY DEFINITION

G. Vali, University of Wyoming, School of Engineering, Dept. of Atmospheric Science, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (NAS 8-33150)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, GUINEA PIG MACROPHAGES FOR ELECTROPHORETIC EXPERIMENT

J. Savage, Alabama Agricultural & Mechanical University, School of Arts & Sciences, Dept. of Biology, *Normal, Alabama* 35762 (NSG 8064)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0002, CHANGES IN CORTISOL AND ANTIDIURETIC HORMONE DURING INDUCED MOTION SICKNESS IN CATS

R.A. Fox, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NSG 2339)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0003, AUTOGENIC-FEEDBACK TRAINING FOR VESTIBULAR SYMPTOMATOLOGY - MASSED VS. DISTRIBUTED TRAINING SCHEDULES

J. Kamiya, University of California, San Francisco Campus, Graduate School, Dept. of Psychology, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665810)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0004, EFFECTS OF IMMUNOLOGICALLY INDUCED GROWTH HORMONE DEFICIENCY ON BODY COMPOSITION, METABOLISM, AND BRAIN DEVELOPMENT

T. Fast, University of Santa Clara, School of Science, Dept. of Biology, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685812)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0005, THE EFFECTS OF SIMULATED WEIGHTLESSNESS (OR HYPOKINESIA) ON THE HUMORAL IMMUNE RESPONSE IN RATS

L.D. Caren, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NCA 2-685813)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0006, HIGH MACH ESCAPE SYSTEM PROTECTION REQUIREMENTS RESEARCH

P.R. Payne, Payne Inc., *Rockville, Maryland* (DF320350; F33615-76-C-0530)

The objectives are to (1) determine forces acting upon crewmen during emergency ejection/extraction from an aircraft flying at transonic and supersonic velocities, (2) measure the influence of crewmen body position upon escape system stability and (3) to develop design criteria for conceptualization of techniques to provide crew protection in high Mach and high g environments.

This investigation includes both analytical and wind tunnel experimental efforts. Experimentation at low velocities will use a full-scale ejection seat and anthropometric dummy to determine the most productive configurations to be evaluated in high velocity, 1/2 scale tests. High-velocity tests will be accomplished by the government using a 1/2 scale model of the crewman and instrumentation provided by the contractor. Data from wind-tunnel tests will be analyzed and reported by the contractor. The analytical effort is directed toward estimation of inertial and aerodynamic forces acting on ejecting crewmen to cause injury and development of requirements for design of personnel protection systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0007, REGENERATION OF PLANT NUTRIENTS FROM WASTE PROCESSING EFFLUENTS

H.P. Meissner, Massachusetts Inst. of Technology, School of Engineering, Dept. of Chemical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 2335)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0008, MAXIMIZING STORAGE STABILITY OF FOODS - EVALUATION OF RESEARCH NEEDS

M. Karel, Massachusetts Inst. of Technology, School of Science, Dept. of Nutrition & Food Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 2334)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0009, ENERGY EXPENDITURE PREDICTIVE MODEL FOR HUMAN OPERATOR PERFORMANCE

D.B. Rogers, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF323820; F33615-78-C-0501)

To develop a unique performance prediction model based on human energetic and workload parameters during acceleration. This modeling approach is in an unexplored area and is of particular importance for evaluation of life support equipment and potential performance limiting factors in new high agility aircraft.

Current models of humans exposed to acceleration forces are primarily cardiovascular models which use visual dimming and light loss as determining criteria. Advances in aircraft technology that allow for high sustained g flight maneuvering now dictate that acceleration effects on workload, fatigue and vision be alleviated by physiological or life support means. A preliminary study of available data indicate that oxygen consumption of the human is related to the incipient g level in a predictable manner. Thus, the relationship between the energetic workload and pilot performance during acceleration will be established in a system effectiveness context. This study will provide a systems construct which will establish a comprehensive predictive model for performance in sustained acceleration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0010, DEVELOPMENT PHASE FOR SPACELAB EXPERIMENT (INS 101)
A.H. Brown, University of Pennsylvania, School of Arts & Sciences, Dept. of Biology, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (NAS 9-15531)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0011, DEVELOPMENT OF A PERCUTANEOUS IMPLANT USING ION-BEAM SPUTTERING TECHNIQUE
J.B. Park, Clemson University, School of Engineering, *Rhodes Research Bldg., Clemson, South Carolina* 29631 (NSG 3225)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0012, NEUROPSYCHOLOGICAL SEQUELAE AND PATTERNS OF DEFICIT IN USAF AIRCREW MEMBERS WITH CLOSED HEAD INJURY
R.D. Wheatley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324320)

To establish base rates and a collection of descriptive data regarding neuropsychological, and other psychometric, sequelae and patterns of deficit in USAF aircrew with closed head injury.

Compares the psychometric test performances of 50 closed-head-injured aircrew with those of 50 non-head-injured matched aircrew controls. Objective neuropsychological, intellectual, and personality measures are used. Inter-group as well as intra-individual comparisons will be carried out so that inferences derived from levels and patterns of performance can be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, UPDATE PIONEER IMAGE CONVERSION SYSTEM (PICS)
R.L. Baker, University of Arizona, School of Engineering, Dept. of Systems & Industrial Engineering, *Tucson, Arizona* 85721 (NAS 2-10089)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0002, REAL-TIME SIMULATION OF COMPUTER-ASSISTED SEQUENCING AND SCHEDULING OF TERMINAL AREA OPERATIONS
R.G. Dear, California State University & Colleges, California State University, Fullerton Campus, School of Business Admin. & Economics, Dept. of Quantitative Methods, *Fullerton, California* 92631 (NCA 2-253801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0003, JOINT DEVELOPMENT OF A DISPLAY SOFTWARE SYSTEM FOR UNSTEADY TRANSONIC FLOW FIELD COMPUTATIONS
J. Mitchem, California State University & Colleges, San Jose State University, School of Science, Dept. of Mathematics, *Washington Sq., San Jose, California* 95192 (NCA 2-675901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0004, MOVING FINITE-ELEMENT METHODS FOR THE TWO-DIMENSIONAL NAVIER-STOKES EQUATIONS
K. Miller, University of California, Berkeley Campus, School of Letters & Science, Dept. of Mathematics, *Berkeley, California* 94720 (NCA 2-50901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0005, JOINT REVIEW OF REQUIREMENTS FOR VERY LARGE-SCALE COMPUTER SYSTEMS
P. Lykos, Illinois Inst. of Technology, Graduate School, Dept. of Chemistry, *3300 S. Federal St., Chicago, Illinois* 60616 (NCA 2-320901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0006, IDENTIFICATION OF HEREDITARY CONTROL SYSTEMS VIA APPROXIMATION TECHNIQUES 15561-M
J.A. Burns, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Mathematics, *Blacksburg, Virginia* 24061 (DA0F9224; DAAG29-78-G-0125)

To develop identification techniques and computational methods of parameter estimation for dynamical systems governed by functional differential equations. Relevance - the work may lead to efficient numerical techniques that could be profitably employed in such Army applications as control and stabilization studies (ARRADCOM-SCL), improved modeling of helicopter dynamics (AVRADCOM), and tactical missile system aerodynamics (MIRADCOM).

The research will be based on the state space formulation for hereditary control systems and approximation techniques for functional differential equations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, PHOTOGRAPHIC SUPPORT OF CHEMICALLY ACTIVE MATERIAL EJECTED IN ORBIT
N.B. Brown, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (NAS 5-25327)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0002, LASER APPLICATION OF INCOHERENT RADIATION

W.E. Lamb, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (NSG 5302)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0003, A STUDY OF MATERIALS PHENOMENA AND LOW-TEMPERATURE PROCESSES

R.A. Armistead, Advanced Research & Applications Corp., *1223 E. Arques Ave., Sunnyvale, California* 94086 (DF051030; F49620-78-C-0010)

AF function - the proposed research primarily falls in the 2.3 research objectives which deal with developing superconducting materials with higher transition temperatures, higher upper critical magnetic fields, lower AC losses and higher current carrying capabilities. Deficiency - new approaches to Air Force power generation and distribution and remote sensing and detection of electromagnetic radiation depend upon new and improved superconducting materials. Josephson junction devices are needed for ultrasensitive detectors of electromagnetic radiation, especially in the ranges of 1-100 microns and 10-6 to 10-5 gauss. Objective - the subject concerns nonequilibrium processes and Josephson tunneling in superconducting films. Contribution - this research is a part of a program in low-temperature physics.

The studies in the Josephson tunneling I-V characteristics of superconductors in nonequilibrium state will be conducted in crossed film, superconductor/oxide/superconductor junctions. The crossed film junctions will be fabricated by thermal evaporation of Sn. A slow oxidation, and a second thermal evaporation of the second Sn electrode will form a complete Sn-SnO-Sn junction. These films make reliable junctions with easily attainable transition temperatures (37 degrees K). They are also useful for forming the first electrode and insulating layer of junctions using another material, for example, Pb or In, for the second superconducting electrode. Such systems allow the study of superconducting energy gaps from quite different, more strongly coupled, superconducting materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, THEORETICAL STUDIES OF SOLAR WIND DYNAMICS

T. Kilpatrick, California State University & Colleges, San Francisco State University, School of Science, Dept. of Physics & Astronomy, *1600 Holloway Ave., San Francisco, California* 94132 (NCA 2-660806)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0005, SURVEILLANCE - ADVANCED LASER SOURCES

A.L. Schawlow, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DN875317; N00014-78-C-0403)

The Navy requires an improved understanding of the principles and associated technology of advanced laser sources in order to evaluate potential applications. The objective of this work is to provide a diversified program of research on the basic physics and demonstration technology of a variety of advanced laser sources. Technological applications will not be directly addressed.

The following approaches will be considered: (1) new techniques will be developed for ultrahigh resolution UV laser spectroscopy; (2) very fast energy extraction techniques will be developed and applied to metastable systems as a means for producing VUV and soft x-ray lasers; (3) several novel schemes using electron beams and including the free electron laser will be investigated as sources for producing intense tunable monochromatic radiation in the visible to x-ray region; (4) laser induced fluorescence will be used to study the energy states of state selected molecules scattered a solid surfaces.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0006, RESEARCH ON SOME PROPERTIES OF NEARLY PERFECT CRYSTALS AT VERY LOW TEMPERATURES

R.F. Wallis, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (NSG 7472)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0007, SOME THEORETICAL STUDIES OF THE PROPERTIES OF CONDENSED MATTER

F.A. Pincus, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-10312)

Research previously supported by DMR7519544.

Theoretical research in condensed matter physics will be carried out. Some of the topics to be studied will include: quantal adiabatic hopping; hopping in the ultra-weak dispersion regime; hopping in a molecular crystal with Morse-type intramolecular vibrational potentials; higher-order multiphonon calculations; the mechanism of self-trapping of electrons, holes and excitons; excitation transfer in disordered systems; spin flip scattering near the glass transition in spin-glasses; magnetic anisotropy of strongly mixed magnetic moments in dilute magnetic alloys; fluctuations in superconductors near the critical temperature; macromolecular physics; polyelectrolytes; deformed entangled polymer solutions; and nematic polymers.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, THE SUPERFLUID PROPERTIES OF LIQUID HELIUM

I. Rudnick, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR76-22306 A02)

Under NSF Grant DMR74-20823 simultaneous measurements were made of the velocity of first, second and fourth sound in superfluid Helium4 using an array of mechanical resonators. Supplementing these data with published data on the expansion coefficient and the entropy at one point, the complete thermodynamics of Helium4 were obtained from 1.2K to T and from vapor pressure to the melting curve. These measurements will be extended down to about 0.4K. Additional experiments to be undertaken with the array of resonators are: (a) a continuing study of the healing length of superfluid as a function of P and T; (b) a study of the Helium3 excitation spectrum in Helium3-Helium4 mixtures and (c) an investigation of the nature of sound propagation in the resonators when the helium is solid. Second sound in superfluid Helium3 has never been observed. Attempts will be made to detect it and measure its velocity using a spherical resonator and a frequency of approximately 3 cps. The fountain pressure in Helium3 will be sought and if found will be used to measure the entropy. For He II in a rotating, cylindrically symmetric vessel, the vortex distribution in equilibrium is not axially symmetric. The model of a rotating, weakly interacting Bose gas will be studied in order to understand how these rotational quantum-phase transitions occur. Additionally, the elastic theory of the recently speculated supersolids will be investigated, especially to understand if and how irrotationality can be consistent with a crystal structure. Although experiments have shown that the low frequency noise is an equilibrium phenomenon there is as yet no theoretical explanation consistent with the laws of thermodynamics. Various models will be investigated within the general framework of the theory of stationary, Gaussian, Markovian processes.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0009, MULTIPARTICLE SPECTROSCOPY EXPERIMENTS
P.E. Schlein, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY77-20762 A01)

This research is in the field of elementary particle physics. The area they will investigate is that of high multiplicity events produced in high-energy hadron-hadron collisions. This year they will continue the analysis of a CERN ISR experiment on high energy pp collision. They will also analyze data on single particle spectra from high-energy and pp interactions at FNAL. Developmental work on a calorimeter to be the basis of proposal to study jets at FNAL will continue.

This work is a continuation of that currently supported under NSF grant PHY-7720762.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0010, STUDIES OF ROTATIONAL GAS CLOUD COLLAPSE, FRAGMENTATION AND DISK FORMATION
S.J. Peale, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (NCA 2-680805)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0011, RESONANT ABSORPTION AND PARAMETRIC DECAY INSTABILITIES IN LASER-GENERATED PLASMAS
P.W. Chan, Colorado State University, School of Engineering, Dept. of Electrical Engin, *Fort Collins, Colorado* 80523 (ENG78-05894)

This program is an experimental investigation of anomalous heating of plasmas produced by irradiation of polysterene targets with carbon dioxide laser radiation. Plasma heating due to resonant absorption at oblique incidence and to the parametric decay instability are being investigated in detail. For the study of resonant absorption, the CO2 laser is split into two beams, one is used for plasma production and the other is used for plasma heating at different angles of incidence. The diagnostics include measurements of absorbed CO2 laser energy using an integrating sphere, measurement of electron and ion energy using a retarding potential energy analyzer, and determination of the spectra of resonant oscillation by incoherent scattering using a probing ruby laser beam. For the study of plasma heating via parametric decay instability, a single CO2 laser beam is used for plasma generation and heating. A probing ruby laser beam is used for scattering to observe the spectra of the electron-plasma and ion-acoustic lines. The frequency shifts of these lines can be used for positive identification of parametric decay instab lity. The linewidths give the damping rate and the line intensities (corresponding to growth rates), which are studied as a function of the incident laser power density. The absorbed laser energy, electron and ion energy are monitored as in the case of resonant absorption. In addition, temporal and spatial resolved holographic interferometry, Schlieren and shadowgram are employed to measure density, density scale length and electron temperature.

This is a continuation of research previously supported under NSF grant ENG-7418623.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0012, INTERMEDIATE VALENCE PHENOMENA IN SOLID SOLUTIONS OF SAMARIUM SULFIDE
J.W. Schweitzer, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (DMR77-26410)

The phenomenon of intermediate of 'mixed' valence associated with rare earth ions in certain compounds and alloys will be studied. Emphasis will be given to the study of the magnetic properties of these materials. There will be a systematic study of solid solutions of SmS with various samarium monopnictides where there is evidence for a chemically induced state of mixed configuration associated with the Sm ions. The lattice parameters, magnetic susceptibility, resistivity, and Hall constant will be measured as a function of temperature. A theoretical study of configuration mixing will be carried out to develop a description for the chemically-induced transitions and magnetic properties.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0013, DYNAMIC PROPERTIES OF LIQUID CRYSTALS
C.E. Tarr, University of Maine, Orono Campus, School of Arts & Sciences, Dept. of Physics, *36 Winslow Hall, Orono, Maine* 04473 (DMR78-10313)

The study of molecular dynamics and orientational order in liquid crystals provides a means of probing important liquid state parameters using well-understood techniques developed for the study of the solid state. Professor Tarr's work falls in this category. It includes several closely related nuclear magnetic resonance studies of liquid crystals. Each of the experiments makes use of the ordering effects of electric fields. In the first experiment, the orientational dependence of deuteron quadrupole splitting is used to obtain uniaxial and biaxial order parameters in the smectic C phases of selectively deuterated compounds. Further, this technique is used to investigate the effects of electric field induced biaxiality in uniaxial phases. Finally, the transient molecular reordering giving rise to bulk flow in nematics is investigated using NMR to monitor molecular orientation in response to electric fields.

This is the first year of a three-year continuing grant.
It is a continuation of work supported by DMR 75-06474.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0014, CORONAL MAGNETIC STRUCTURE AND THE LATITUDE AND LONGITUDE DISTRIBUTION OF ENERGETIC CHARGED PARTICLES
E.C. Roelof, Johns Hopkins University, Graduate School, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAS 8-33106)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0015, GRATING FACILITY USE
W.G. Fastie, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAS 5-25358)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0016, A COMPARATIVE STUDY OF METER-DECAMETER BURSTS WITH X-RAY LOOPS AND FLAMING BRIGHT POINTS AS OBSERVED BY THE SKYLAB S-054 EXPERIMENT
L.M. Rundu, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NAS 8-33105)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0017, THEORY OF THE ELECTRONIC PROPERTIES OF DISORDERED METALS
L.M. Schwartz, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR-77-27249)

Theoretical research on the electronic properties of disordered condensed matter systems previously supported by DMR-7203209 A02 will be continued. Systems under investigation in-

clude substitutional and interstitial alloys, liquid metals, and metallic glasses with particular emphasis on noble metals and transition metal constituents. This research is directed to the development of new self-consistent formal techniques as well as the application of existing techniques such as the average t-matrix approximation to determine the electronic states and properties of disordered systems.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0018, RARE EARTH LASER MATERIALS

A. Linz, Massachusetts Inst. of Technology, Crystal Physics Lab., *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN880114)

Growth, fabrication and characterization of various fluoride and oxide host crystals with one or more trivalent rare earth ions as dopants or major constituents.

Host crystals with various dopants to be selected by contract monitor will be grown or purchased. Samples of appropriate size will be fabricated and tested and supplied to NRL.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0019, APOLLO TELESCOPE MOUNT GUEST INVESTIGATOR PROGRAM FOR MODELING OF QUASI-STATIC CORONAL LOOPS AND ARCADES

S. Frankenthal, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAS 8-33138)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0020, PROTOFLIGHT LANGMUIR PROBE INSTRUMENT FOR DYNAMICS EXPLORER

G.R. Carignan, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical Engineering, *Ann Arbor, Michigan* 48104 (NAS 5-25409)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0021, DYNAMIC EXPLORER A&B MAGNETOMETER EXPERIMENT SUPPORT

L.J. Cahill, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (NAS 5-25389)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0022, MOLECULAR SPECIES PRESENT IN THE NEUTRAL EFFLUX OF THE SOLID TEFLON PULSED PLASMA THRUSTER

J.K. Hartman, Canisius College, School of Arts & Sciences, Dept. of Physics, *Main & Jefferson Ave., Buffalo, New York* 14208 (DF051960; AFOSR-78-3579)

AF function - space systems, communications satellites. Deficiency - the technology for reliable long-life repeating propulsion systems is not in hand. In part, this is due to lack of sufficient fundamental knowledge about the working fluid of plasma thrusters. Objective - this work will be concerned with performing a variety of mass spectrometer measurements on the plasmas generated in a small solid teflon pulse plasma thruster, in order to improve understanding of the neutral portion of the exhaust beam. How work contributes - it is hoped that the resulting improvement in knowledge will help alleviate users' fears of spacecraft contamination and facilitate design of future plasma thrusters and spacecraft.

A borrowed teflon pulse plasma thruster will be made part of a mass spectrometer-vacuum system. The concentration and velocity distributions of neutral species in the thruster exhaust will be measured under various operating conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0023, ELECTRONIC STRUCTURE AND MAGNETIC EXCITATIONS IN DISORDERED MATERIALS

L.M. Roth, State University of New York, Albany Campus, School of Science & Mathematics, Dept. of Physics, *1400 Washington Ave., Albany, New York* 12222 (DMR75-18104 A01)

Research previously supported by DMR75-18104.

Theoretical research in condensed matter physics will be carried out. The emphasis will be on understanding the electronic structure of liquid and amorphous metals and alloys. The solution of this problem is one of the most challenging in these technologically important materials.

Single site theories, especially the effective medium approximation, will be applied to a potential model of a liquid metal to calculate the density of states and Knight shift, and with suitable extensions of the theory, conductivity and Hall effect. This approach will be applied to study mercury and other divalent liquid metals, amorphous metal-metalloid alloys and semiconducting alloys.

Alsc to be investigated are magnetic excitation in magnetic alloys using the coherent potential approximation. The spectral weight function and density of states will be compared with neutron diffraction results and computer simulation. Magnetic excitations in an amorphous ferromagnet will be studied using an extension of the effective medium approximation. Magnetization and specific heat will be calculated, and excitations at long and short wavelengths will be examined for various forms of the exchange. The effects of finite temperature will also be studied, for comparison with experimental results in amorphous metal-metalloid alloys.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0024, STUDY OF THE EFFECTS OF HIGH-ENERGY RADIATION ON THE MECHANICAL PROPERTIES OF GRAPHITE-FIBER REINFORCED EPOXY RESINS

J.D. Memory, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (NSG 1562)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0025, CONVECTION IN CRYSTAL GROWTH AND G-JITTER

S. Ostrach, Case Western Reserve University, Graduate School, Dept. of Fluid Thermal Science, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NSG 3221)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0026, SUPERCONDUCTIVITY AND RADIATION-INDUCED DEFECTS IN A-15 COMPOUNDS

B.S. Chandrasekhar, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (DMR77-09948)

A study of the anisotropy of the superconducting energy gap in high transition temperature A-15 superconductors will be undertaken to determine whether the anisotropy is an essential ingredient for the observed high Tc. A comprehensive set of measurements will be made on well-characterized single crystals of V3Si which have been subjected to various fluences of 50 MeV protons. Specific measurements such as the electrical resistivity, the elastic constants, the specific heat, the annealing and recovery times and the positron lifetimes will be made for the samples to

determine the mean free path and anisotropy. Transmission electron microscopy will be used to study details of the defect structure. The program will provide data on the fundamental electronic and structural parameters of single crystals in the defect state. The immediate goal of the program is an improved understanding of the phenomenon of high-temperature superconductivity in the A-15 materials.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0027, RAMAN SCATTERING IN GROUP VB AMORPHOUS AND CRYSTALLINE SEMICONDUCTORS
J.S. Lannin, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (DMR76-81605)

Raman scattering measurements in amorphous arsenic, phosphorus and their related crystalline layer-like systems will be carried out. The study will provide basic information about the vibrational spectra of the amorphous materials, and the influence of preparation conditions on these properties. The crystalline counterparts with black P structure will be studied to obtain information about the long wavelength vibrational modes, the phonon density of states and their relation to the amorphous vibrational spectra. These results will provide a more detailed understanding of the structure and bonding of elemental group Vb solids.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0028, STATISTICAL MECHANICS AND THEORY OF SOLIDS
H.B. Callen, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DMR76-21703 A02)

Research on the statistical mechanical properties of condensed matter carried out under NSF grant DMR72-03146 will be continued. Common to several aspects of this program is the use of renormalization-group techniques in phenomena other than thermodynamic phase transitions. In particular, such techniques will be used for studies of percolation, the theory of random systems, and the problem of turbulence. The latter, and the study of systems far from thermodynamic equilibrium, represent new areas of interest to be pursued during this grant period.

Further investigations using the renormalization group on the various liquid crystal phase transitions, and on phase transitions of surfaces will be carried out.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0029, DEVELOPMENT OF THEORETICAL MODELS FOR GRAPHITE-LIKE ATOMIC STRUCTURES
S. Rabii, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (NAS 2-10070)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0030, SURFACE QUANTIZATION AND ELECTRON-ELECTRON INTERACTIONS
P.J. Stiles, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR77-10218 A01)

Experimental studies of the electronic transport properties of inversion and accumulation layers in semiconductors will be continued. This is an extension of research previously supported by NSF grant DMR-7302401. Measurements of the magnetoconductivity, Shubnikov-de Haas effect, cyclotron resonance will be used to investigate the one-electron states as well as the one-electron and many-electron excitations of the quasi-two-dimensional (Q2D) electron gas localized at the interface between silicon and silicon dioxide. Specific topics to be addressed include: the formation of superlattices in Q2D systems; measurement of Q2D plasmons; electron-phonon interactions in Q2D electron systems; and the localization of electronic states due to potential fluctuations.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0031, SMALL ANGLE NEUTRON SCATTERING FROM FERROFLUIDS
A.C. Nunes, University of Rhode Island, School of Arts & Sciences, Dept. of Physics, *Woodward, Kingston, Rhode Island* 02881 (DMR78-03024)

A ferrofluid (a collodial suspension of magnetic particles) is a magnetic fluid which has unique applications in rotating seals and particle separators. As a collection of subdomain sized particles a ferrofluid is a physically interesting magnetic system, a superparamagnet, whose properties are presumably dominated by surface phenomena, because of their relatively large surface to volume ratio. Several measurements of ferrofluids have demonstrated magnetic properties significantly different from the bulk materials. Most of these techniques measure volume averages however, and there is little direct information of the magnetic structure of the particles themselves. A polarized neutron small angle scattering investigation of a ferrofluid will be undertaken to ascertain the chemical makeup and magnetic structure of a colloidal ferrite suspended in water. This will be the first application of small angle neutron scattering to such a system. Results will be compared with model predictions. Experience gained in this work may also have technological ramifications in the field of polarized neutron scattering as a polarizing filter.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0032, NEUTRINO INTERACTIONS AT COSMIC RAY ENERGIES
R.E. Mickens, Fisk University, Graduate School, Dept. of Physics, *17th Ave. N., Nashville, Tennessee* 37203 (NSG 5297)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PHOTOELECTRIC OBSERVATIONS OF LUNAR OCCULTATIONS
N.M. White, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST76-82248 A01)

Photoelectric timings of occulations of stars by the moon are an inexpensive way of providing basic data necessary to monitor changes in and improve the accuracy of the orbital elements of the moon. Occultation timings will enable accurate determination of the moon's position relative to the stars. Also, photoelectric observations of the diffraction pattern 'shadow' which sweeps across the surface of the earth as the moon passes in front of a star provide the highest angular resolution of multiple stars and stellar diameters. Resolution well beyond the diffraction limit for the telescope is attained by this technique. These observations will provide basic data that bears directly upon important astrophysical and even cosmological questions. The full potential of this program can only be realized by a continuing observational program over a number of years at several observing sites. Support will permit this continuity, using more than one telescope and wavelength range in favorable cases. Near infrared photometry and classification of all angular diameter stars will be attempted as part of an existing program. A four-channel pulse-counting system will be added.

Prior support was by NSF grant AST 76-82248.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, INSPECTION AND TESTING OF THE OPTICAL QUALITY OF THE KUIPER AIRBORNE OBSERVATORY'S 91 CM TELESCOPE

Unknown, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (NAS 2-10085)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0003, HIGH-SPECTRAL-RESOLUTION POLARIMETRY OF STARS

G.V. Coyne, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST77-08386)

The aim of this study will be to obtain and interpret polarimetric data at high spectral resolution on a large sample of stars which are known to exhibit considerable polarization structure with wavelength. These include Be and shell stars, close binaries, X-ray binaries, dwarf novae and late-type giant stars. This work will be directed towards an interpretation of those stellar objects with extended atmospheres and/or circumstellar environments, including stars involved in mass exchange or mass loss.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, THEORETICAL STUDIES OF INTERPLANETARY MAGNETIC FIELDS, TURBULENCE AND COSMIC RAYS

E.H. Levy, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (ATM76-17058 A01)

A significant part of the sun's influence on the earth and the planets is exerted through the intermediary of the solar wind. In addition, our general ideas about the behavior of astrophysical plasmas can be directly tested only in interplanetary space. For these reasons solar-wind studies have relevance over wide areas of science.

The grant continues support for theoretical studies of a range of basic solar-wind properties and behaviors. In this continuing program, the investigations undertaken will include the effects of turbulence influctuations on measured radial variations of, for example, solar-wind density, the interplanetary magnetic field and the density of cosmic rays. Also the large-scale morphology of the interplanetary magnetic field will be studied, with particular emphasis given to the effect of the field's structure on cosmic-ray propagation and anisotropies. Scintillations in the flux of astronomical radio waves are produced by turbulence and fluctuations in the solar-wind. This has opened an avenue for ground-based studies of solar-wind variations. Since the theory of these scintillations is still incomplete, research into the causes of radio scintillations will be undertaken.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0005, INFRARED STUDIES OF STAR FORMATION

R.I. Thompson, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST78-20393)

This research will be devoted to a program of investigation of the protostellar and pre-main sequence states of star formation. Infrared spectroscopy will be used to obtain information on the properties of these objects. Such objects are often hidden at visible wavelengths by the surrounding dust. Because of this, often the only direct evidence on the properties of a protostellar object comes from infrared emission lines of hydrogen. It has been found that disks of material surround some newly forming stars. The properties of such disks will be studied. It has been suggested that these disks may be the site of planetary formation. The T Tauri stars are another type of pre-main sequence object. They have a variable light output. Many of these stars are surrounded by circumstellar dust shells. There are a number of problems associated with interpreting the phenomena observed from these stars. Information over as broad a wavelength band as possible is extremely useful in analyzing the physical properties of such systems. The facilities of the Steward Observatory will be used to carry out simultaneous optical and infrared monitoring of these stars.

Infrared emission lines due to molecular hydrogen have now been detected in the nucleus of a Seyfert galaxy. Since molecular hydrogen is observed in star formation regions of our own galaxy, it may be that star formation is taking place in external galaxies. Other galaxies will be observed in order to determine the extent of extragalactic molecular hydrogen emission. It may then be possible to determine star formation sites in external galaxies which are obscured from sight at visible wavelengths.

This is a continuation of research previously supported under NSF grant AST77 20369.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, HIGH-RESOLUTION INTERFEROMETRY OF SOLAR RADIO SOURCES

H. Zirin, California Inst. of Technology, Graduate School, Dept. of Astrophysics, *1201 E. California Blvd., Pasadena, California* 91109 (ATM76-80782 A01)

This grant continues a program of high-resolution interferometry of the quiet and active sun at the Owens Valley Radio Observatory, California. Solar bursts will be measured at 2.8 cm with 1 sec time resolution, 4 arc sec one-dimensional resolution and compared with simultaneous optical data. Equipment to reduce the time constant to 0.1 sec and to keep bursts from saturation will be developed. Data already accumulated will be further analyzed. A program of observations at the Very Large Array (VLA) will be carried out.

The work should result in new understanding of the size and intensity distribution in solar flare bursts, the height of the energetic source, and the relation of the polarization to magnetic field structure. The quiet sun work will give new data on temperature fluctuations in the chromospheric network.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0007, THEORETICAL STUDY HARD X-RAY EMISSIONS FROM CYGNUS X-1 USING THE HEAO-A OBSERVATIONAL RESULTS

R.V. Wagoner, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (NAS 8-33234)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0008, OPTICAL OBSERVATIONS OF CELESTIAL X-RAY SOURCES

C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST78-06873)

The research to be carried out on this grant will be concerned with ground-based optical observations of celestial X-ray sources. Observations will be made of the source Aquila X-1 in order to obtain information on the long-term optical and X-ray behavior of this source. There will be observations of the X-ray pulsar AO535 plus 26 in order to determine if it and other transient X-ray stars are binary systems. The X-ray source $co X-1, which is the brightest X-ray source in the sky, will be studied. Observations at optical wavelengths will be obtained at the same time as observations are made at other wavelengths. High galactic latitude X-ray sources will also be examined. There will be simultaneous optical observations on X-ray sources as they are being scanned by the HEAO-1 X-ray satellite. A search will be made for the optical counterparts of Southern Hemisphere galactic X-ray sources. Finally, there will be optical studies of low-luminosity stars associated with Southern Hemiphere galactic X-ray sources.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0009, THEORETICAL CALCULATIONS OF SPECTRAL FEATURES IN THE EXPANDING ENVELOPES OF EARLY-TYPE STARS
P.S. Conti, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astrogeophysics, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7430)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0010, RESEARCH OF STELLAR WIND VELOCITY IN ALPHA CAM USING ULTRAVIOLET DATA FROM THE INTERNATIONAL ULTRAVIOLET EXPLORER (IUE)
T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NSG 5300)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0011, HIGH-RESOLUTION SPECTROPHOTOMETRIC OBSERVATION OF INTERSTELLAR ABSORPTION LINES
T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7477)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0012, ULTRAVIOLET MEASUREMENTS WITH HIGH SPECTRAL RESOLUTION
T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NSG 5303)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0013, DIGITIZATION SYSTEM FOR THE MANN MEASURING ENGINE OF THE VAN VLECK OBSERVATORY
A.R. Upgren, Wesleyan University, Graduate School, Dept. of Astronomy, *Middletown, Connecticut* 06457 (AST77-26554 A01)

Support is for the purchase and installation of a digitization system and remote computer terminal for the Mann Measuring Machine of the Van Vleck Observatory to replace the present system which is no longer serviceable. The digitization system will render astrometric measurements onto IBM punch cards for automatic data processing or feed the measures directly into the university computer. The system is of critical importance to continued efficiency and productivity in the astrometric research programs currently in progress at the observatory for which the measuring machine is used. These programs include the measurement of parallaxes and proper motions of the Van Vleck and Venezuelan (CIDA) Observatories, currently supported by NSF grants, and the measurement of stellar radial velocities on objective-prism plates, currently partially supported by a sequence NSF grant.

Prior support was by NSF grant AST 77-26554.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0014, PLANETARY ATMOSPHERES
M.D. Scheer, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20234 (3160407)

PROJECT OBJECTIVE: Provide data on the photochemistry of CO2, H2O, NH3, CH4 and higher hydrocarbons so that computer simulation of the planetary atmospheres can be performed.

PROJECT APPROACH: Apply the techniques of reaction kinetics, photochemistry, and molecular spectroscopy to the laboratory study of the atmospheric constituents of Venus, Mars, Jupiter and the Jovian satellites.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

10.0015, MODIFICATIONS TO AND OPERATIONS AND MAINTENANCE OF THE LUNAR LASER OBSERVATORY AT THE UNIVERSITY OF HAWAII (ABBREV)
S.F. Cushman, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (NAS 5-25181)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0016, PROVISION OF SUPPORT DURING THE PREPARATORY STAGE FOR OPERATION OF THE NASA INFRARED TELESCOPE FACILITY
J.T. Jefferies, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (NASW 3159)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0017, ULTRAVIOLET SPECTRA STUDY OF NORMAL STARS
P.P. Fahey, Montgomery College, Rockville Campus, Undergraduate School, *51 Mannakee, Rockville, Maryland* 20850 (NAS 5-25120)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0018, COSMIC RAY SPECTRA AND THEIR COMPOSITION IN THE ATMOSPHERE FROM 0.1 TO 50 TEV AND STRONG INTERACTIONS AT VERY HIGH ENERGIES
G.B. Yodh, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (PHY77-01438 A01)

An experiment is designed to measure the attenuation of primary cosmic-ray protons in the atmosphere to determine the interaction length of protons in air up to 20 TeV. The nucleon-nucleon cross section is subsequently derived. A balloon-borne detector will measure the primary cosmic-ray spectrum up to 50 TeV. A multi-element detector is to be built to measure charge multiplicities from interactions up to 100 TeV. Development of a transition radiation detector to measure the cosmic-ray flux of highly charged nuclei of relatively low velocity. This research is a continuation of that initiated under NSF Grant PHY76-14853.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0019, HEATING OF THE SOLAR CORONA
D.G. Wentzel, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (ATM77-07624)

Space observations, especially from Skylab, have provided new clues to use in theories for the heating of the solar corona. 1) Coronal loops seen by X-ray emission suggest heating by Alfven waves. However, the theory for the heating of loops by waves works only if the waves have periods rather smaller than is normally expected. This work will evaluate the nonlinear dynamics of waves rising from the photosphere to demonstrate that such short wave periods are indeed generated. This has immediate application both to solar observations and to theories for the heating of all the solar layers above the photosphere. 2) Motions in the photosphere may contribute to the heating of the corona by inducing the dissipation of corona electric currents and magnetic fields. Apparently most of the fields relax rather readily, as is indicated by the observed corona loops, by the migration of cosmic rays around the Sun, and by the theoretical requirement that currents entering the corona must leave it again. This work will relate

these indications of easy field relaxation to theories for the dissipation of magnetic fields and thus to reduce substantially the uncertainties inherent in theories for the heating of the corona by magnetic fields.

The overall aim of this grant is to support theoretical studies of the way in which the solar corona is heated and accelerated to become the solar wind. This is at present not understood.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0020, COMPUTER-ASSISTED PERFORMANCE TESTS OF THE LYMAN-ALPHA CORONAGRAPH
W.H. Parkinson, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NSG 7461)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0021, DATA REDUCTION AND ANALYSIS ON SMALL ASTRONOMY SATELLITE
G.W. Clark, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAS 5-24441)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0022, DESIGN AND DEVELOPE A COMPTON TELESCOPE FOR THE GAMMA RAY OBSERVATORY (GRO) MISSION
J.A. Lockwood, University System of New Hampshire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (NAS 5-25420)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0023, FIELD-DEPENDENT COSMIC-RAY ANISOTROPIES IN INTERPLANETARY SPACE AT HIGH RIGIDITIES
V.H. Regener, University of New Mexico, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Hill N.E., Albuquerque, New Mexico* 87106 (ATM76-11743 A01)

This grant will continue studies of cosmic-ray anisotropies in interplanetary space surrounding the Earth, and of their dependence on the characteristics of the interplanetary magnetic field, using an expanded network of large underground cosmic-ray telescopes. This work is expected to yield information on cosmic-ray modulation at high energies, which can only be reached with underground detectors, as a function of the parameters of the interplanetary magnetic field, and of the solar magnetic field. The field-dependent anisotropies being investigated are particularly amenable to study in the forthcoming period of solar maximum. Support is being requested for the continued data acquisition, reduction and interpretation, as well as for the continued operation, for two years, of two currently operating large multi-directional meson telescope recorders (4 square meters each) at Embudo Cave, and Socorro, New Mexico; also for the installation and operation of a giant telescope (18 square meters) at a greater depth underground in Arizona.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0024, CLASSIFICATION OF BRIGHT GIANT STARS AND SUBGIANT STARS OF TYPES G, K AND M
P.C. Keenan, Ohio State University, Columbus Campus, School of Arts & Sciences, Dept. of Astronomy, *190 N. Oval Dr., Columbus, Ohio* 43210 (AST78-07491)

This project will be concerned with the spectral classification of late-type stars. The observations will be made at the Perkins 72-inch reflector at the Lowell Observatory at Flagstaff, Arizona. The project will involve the classification of suspected subgiant or giant stars. The precise classification of such stars will enable one to obtain more accurate estimates of the distances to stars that have very small or insignificant parallaxes.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0025, A SEARCH FOR VARIATIONS IN THE SPECTRUM
A.E. Slettebak, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Astronomy, *164 W. 17th Ave., Columbus, Ohio* 43210 (NSG 5299)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0026, CONSTRUCTION AND INSTALLATION OF A REMOTELY CONTROLLED CASSEGRAIN SPECTROGRAPH SYSTEM FOR THE MCDONALD OBSERVATORY 2.7-METER TELESCOPE
H.J. Smith, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-23326)

A Cassegrain spectrograph system will be constructed and installed at the 2.7-meter (107-inch) telescope of the McDonald Observatory of the University of Texas. The design of this system will be modelled on the automated Miller spectrograph at the Lick Observatory of the University of California. The system will consist of four major parts: (1) the telescope utility bench, which will support the spectrograph, detector calibration lamps and the television guiding system; (2) the Cassegrain spectrograph; (3) the detector system, and (4) the readout and data handling system.

Actual construction of most of the parts of the system will be carried out at the McDonald Observatory Shop, located at the Bee Caves Research Center and Observatory. Construction should take approximately one year. Installation and operation will begin in the second year.

Scientific projects that will make use of the new spectrograph will cover many areas of astrophysics: radio galaxies, galaxies in clusters, quasistellar objects, time-resolved spectroscopy of rapidly varying stellar sources such as cataclysmic binaries, variable white dwarf stars, dwarf cepheids, and flare stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

GENERAL

11.0001, A JOINT VENTURE TO CONSOLIDATE LAW LIBRARY COLLECTIONS AND PRODUCE FOR MUTUAL USE AND BENEFIT ADMINISTRATIVE LAW PRACTICE MANUALS
T. Wolcott, University of California, Hastings College of Law, School of Law, *198 McAllister St., San Francisco, California* 94102 (NCA 2-280801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

11.0002, OPERATION OF AN INDUSTRIAL APPLICATIONS CENTER
Unknown, University of Connecticut, Storrs Campus, Graduate School, *Storrs, Connecticut* 06268 (NASW 3191)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

11.0003, A HISTORY OF CELESTIAL MECHANICS
C.A. Wilson, St. Johns College, Graduate School, Dept. of Mechanics & Materials Science, *Annapolis, Maryland* 21404 (SOC78-05168)

Dr. Wilson, working with Dr. Clifford Truesdell, is assembling a detailed and analytical account of crucial phases in the development of planetary and astronomy during the second half of the eighteenth century, with emphasis on the relations between theory and observation. During this period the accuracy of planetary tables was improved by an order of magnitude, from a matter of sometimes nearly half a degree to one or a few seconds of arc. As is well known, this achievement depended importantly on the work of Euler, d'Alembert, Clairaut, Lagrange and Laplace in bringing the analytical treatment of the inverse-square law of gravitation to bear on astronomical problems. It also depended not insignificantly on a new sophistication in assembling and utilizing empirical data. Already in the 1750's, the basic coordinate system as embodied in solar theory (which has to do with the motion of the planet earth) was sufficiently refined, on the basis of the theory of perturbations, as to require little later revision. Only in the 1780's, however, was a major and very troublesome anomaly in the motions of Jupiter and Saturn resolved. And it was in the same decade that sophisticated methods for the combining of observations in the determination of orbital elements were first employed. In the main, what the existing literature tells us is that these things happened. To throw light on how they happened is the purpose of the research.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N79-18885# Society of Experimental Test Pilots, Lancaster, Calif.
SETP TECHNICAL REVIEW, VOLUME 14, NO. 2: 1978 REPORT TO THE AEROSPACE PROFESSION, 22D SYMPOSIUM PROCEEDINGS
1979 225 p refs Symp. held at Beverly Hills, Calif., 27-30 Sep. 1978
Avail: NTIS HC A10/MF A01

Air safety is promoted by presenting the pilot's opinion. Information on flight equipment, aeronautical progress, testing techniques, escape and survival procedures, and the realm of flight is discussed. Interest in careers through scholarships and professional and fraternal relationships is stimulated. For individual titles, see N79-18886 through N79-18900.

N79-18886# General Dynamics Corp., San Diego, Calif.
F-16 HIGH ANGLE OF ATTACK TESTING **c05**
Philip F. Oestricher and Robert C. Ettinger (AFFTC, Edwards AFB, Calif.) *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 1-10 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

A fly-by-wire flight control system is developed to allow a fighter pilot the maneuverability of reckless abandon. Vigorous air combat maneuvering without the concern of maintaining the aircraft was proved. Ballistic flight and full lateral stick rolls were examined. The angle of attack and structural limiting features were found to provide protection in air combat maneuvering. S.E.S.

N79-18887*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE ORBITAL FLIGHT TESTING **c16**
Henry W. Hartsfield, Jr. *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 11-20 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01 CSCL 22B

The current plan for a flight test program to support the Skylab revisit and to accommodate changes in the schedule is presented. The stability and control aspects of the entry flight phase are discussed. The orbiter flight control effectors and their characteristics are described. The approach chosen for orbital flight testing was examined. S.E.S.

N79-18888# McDonnell-Douglas Corp., St. Louis, Mo.
F-18 STATUS REPORT **c05**
John E. Krings *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 21-25 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The entire F-18 program, including the design of the cockpit, displays, weapon system integration, and approach configuration, is outlined. Fly-by-wire digital system of the F-18 is described. Aerodynamic refinements were finalized in flight simulations. S.E.S.

N79-18889# Israeli Air Force, Zahal.
FLIGHT TESTING THE KFIR **c05**
Yitzhak Peer *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 26-37 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The canard concept to improve the supersonic maneuvering of the Mirage 3 aircraft is developed. This test program included redesign of the cockpit, integration of modern weapons delivery system with headup display, the improvement of the flight control system, and aerodynamic configurations modification design. An engine for greater combat maneuvers was examined. S.E.S.

N79-18890# Rockwell International Corp., Canoga Park, Calif. Collins Avionics and Missiles Group.
COCKPIT MANAGEMENT **c05**
C. I. Rice *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 39-42 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

A challenge to avionic manufacturers, airframe manufacturers, and test pilots is presented. Cockpit management in general, aviation, air transport, and military aircraft are discussed. S.E.S.

N79-18891# Garrett Corp., Torrance, Calif.
SMALL FAN-JET ENGINES **c07**
Ivan E. Speer *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 43-51 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The changes from straight jets to medium bypass fans in business aircraft power plants are presented. The cycle for business aircraft at higher altitudes is discussed. The changes to the fan engine to improve fuel consumption, reduce weight, increase reliability and durability, and reduce noise are described. S.E.S.

N79-18892# NCR Corp., Los Angeles, Calif.
CORPORATE AVIATION IN THE 1980'S
Donald T. Keeley *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 52-56 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The problems of corporate aviation and corporate aircraft are discussed. The planned environment of the airline pilots, commuter pilots, military pilots, and test pilots was studied. S.E.S.

N79-18893# Cincinnati Univ., Ohio.
THE LEARJET LONGHORN SERIES: THE FIRST JETS WITH WINGLETS **c05**
Neil A. Armstrong and Peter T. Reynolds (Gates Learjet Corp.) *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 57-66 refs (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The Gates Learjet Model 28 is described following the first test flight. The cruise fuel flow is increased and the takeoff and landing performance is improved. The cruise fuel flow reductions are the result of several factors: (1) the aircraft can operate at higher altitudes due to the added wing area; (2) for the same payload and range, the takeoff weight will be lower because less mission fuel is required; and (3) drag is reduced by removing

the tip tanks, increasing the aspect ratio and adding the winglets. S.E.S.

N79-18894*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLYING NASA'S TERMINAL CONFIGURED VEHICLE AGAINST THE MICROWAVE LANDING SYSTEM **c05**
Lee H. Person, Jr. and Kenneth R. Yenni *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 110-123 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01 CSCL 01C

Technology for advanced airborne systems and flight procedures to improve terminal-area operations in ATC environment is developed. The terminal configured vehicle (TCV) aircraft, its integrated digital electronic displays and flight controls, and how the pilot interfaces with the aircraft to fly precise curved descending approaches using Microwave Landing System (MLS) guidance are discussed. S.E.S.

N79-18895# Lockheed Aircraft Corp., Burbank, Calif.
DEVELOPMENT OF THE L-1011 FLIGHT MANAGEMENT SYSTEM **c05**
Donald A. Moor *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 124-134 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The Lockheed/Army Flight Management System is described in preparation to make present and future generations more efficient. A means for automatic, precise control of aircraft speeds and engine thrust during climb, cruise, and descent; full time performance management in areas of near neutral speed-thrust stability, reducing crew workload, and offering a large potential for fuel savings are discussed. S.E.S.

N79-18896# Boeing Co., Seattle, Wash.
THE CONTINUITY FACTOR IN AIRCRAFT DEVELOPMENT **c05**
A. M. Johnston *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 135-145 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The continuity factor is the respective sequential application of tested and desirable and undesirable technologies. Vehicle models are studied to indicate when the continuity factor is appropriately applied, and the respective product excels. S.E.S.

N79-18897# Rockwell International Corp., Canoga Park, Calif.
XF4D SKYRAY DEVELOPMENT: NOW IT CAN BE TOLD **c05**
Robert O. Rahn *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 147-161 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The XF4D is a single-place, low aspect ratio, delta-wing interceptor-type airplane which is described. Primary longitudinal and lateral control is accomplished by use of differentially acting elevons located along the trailing edge of either wing. Longitudinal and lateral trim is obtained from trimmers located inboard of the elevons. Directional stability and control are obtained from a single swept vertical surface lying in the plane of symmetry. The elevons are actuated by a single irreversible power control system with feel for the pilot provided by a system utilizing electrical magnetic clutches. Rudder operation by the pilot is by a direct-connected cable system. The airplane is equipped with a yaw damper which also actuates the rudder through a servo-system. A manual flight control system for the elevons was provided should failure of the power system occur. An emergency auxiliary electrically-driven hydraulic pump was added for flight tests. A unique, four-wheel landing gear was designed which utilized a small retractable tail wheel to absorb the tail loads during high angle of attack landings. S.E.S.

N79-18898*# National Aeronautics and Space Administration, Washington, D. C.
WHEN FLIGHT TEST WAS THE ONLY WAY **c05**
A. Scott Crossfield (US House Sci. and Technol. Committee) and Walt Williams *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 162 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01 CSCL 01C

A look at past events that have helped aviation technologies and procedures progress is presented. S.E.S.

N79-18899# Lockheed Aircraft Corp., Burbank, Calif.
THE U-2 STORY **c02**
Kenneth W. Weir *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 186-192 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The progress of the U-2 aircraft is presented. The high altitude flights, the canopy, flight control system, and size comparisons are described. S.E.S.

N79-18900# Society of Experimental Test Pilots, Lancaster, Calif.
FLIGHT OF THE DOUBLE EAGLE 2 **c02**
Ben L. Abruzzo, Larry Newman, and Maxie L. Anderson *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 205-213 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

The feelings of the three crewmen who were on board the Double Eagle 2 balloon flight are described. S.E.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-18901*# Bell Aerospace Textron, Buffalo, N. Y.
GENERAL PURPOSE COMPUTER PROGRAM FOR INTERACTING SUPERSONIC CONFIGURATIONS: PROGRAMMER'S MANUAL
W. Crill and B. Dale [1977] 218 p
(Contract NAS1-13987)
(NASA-CR-145127) Avail: NTIS HC A10/MF A01 CSCL 01A

The program ISCON (Interacting Supersonic Configuration) is described. The program is in support of the problem to generate a numerical procedure for determining the unsteady dynamic forces on interacting wings and tails in supersonic flow. Subroutines are presented along with the complete FORTRAN source listing. F.O.S.

N79-18902 Houston Univ., Tex.
AN EXPERIMENTAL INVESTIGATION OF VORTEX PAIRING IN A CIRCULAR JET UNDER CONTROLLED EXCITATION Ph.D. Thesis
Khairul B. M. Quamruzzaman 1978 376 p
Avail: Univ. Microfilms Order No. 7906270

The large-scale coherent structures in the near field of circular free jets were studied by organizing these structures through controlled acoustic excitation. Hot-wire and flow-visualization investigations were carried out in three air jets (of diameters D = 2.54 cm, 5.27 cm, and 7.62 cm) with both initially laminar and turbulent boundary layers, over a wide range of the jet Reynolds number DUe/v. The roll-up of the initial axisymmetric shear layer into vortex rings, and their subsequent evolution and interactions like pairing, are found to strongly depend on the excitation Strouhal number. It is also found that under certain conditions of excitation, the jet turbulence can be decreased to values lower than those of the unexcited jet. Dissert. Abstr.

N79-18903 Johns Hopkins Univ., Baltimore, Md.
SOME ASPECTS OF UNSTEADY INSECT AERODYNAMICS: ACCELERATION POTENTIAL METHODS IN PLANE UNSTEADY AIRFOIL THEORY, AND MEASUREMENTS OF UNSTEADY-PERIODIC FORCES GENERATED BY THE BLOWFLY Ph.D. Thesis
Richard Hugh Buckholz 1978 363 p
Avail: Univ. Microfilms Order No. 7906436

A simple dynamic force balance was developed and applied to the measurement of the instantaneous lift and drag forces generated by a blowly flying fixed in a wind tunnel. The novel force balance was a simple, taut, wire string with fixed ends; the live insect is mounted near the strong midpoint. The instantaneous force exerted by the blowfly's thorax on the wire was measured by detection of miniscule wire motion. This force

was attributed to both wing inertial forces and wing aerodynamic forces. Subsequently, the former were computed from the kinematics of fly wings as photographed and measured by Nachtigall (1966). The phase relation between the wing kinematics and the streamwise insect forces was measured. It was found that the periodic lift and drag forces experienced by the insect's thorax during flapping flight contained a surprisingly small amount of higher harmonics of the wing beating frequency.
Dissert. Abstr.

N79-18904 Akron Univ., Ohio.
FINITE ELEMENT ANALYSIS OF INVISCID SUBSONIC FLOW WITH VISCOUS INTERACTION AND INVERSE APPLICATIONS Ph.D. Thesis
Rodrick Virgil Chima 1979 236 p
Avail: Univ. Microfilms Order No. 7906143

A finite element method was developed for the analysis of inviscid, subsonic compressible flow about arbitrary two dimensional and axisymmetric bodies for a range of Mach numbers from zero (incompressible) to about 1.0. A Galerkin finite element formulation of the compressible flow equations in primitive variables was developed. Two variables, the velocity components, were solved directly at each node in the flow field. A strongly convergent iterative scheme for solution of the resulting nonlinear algebraic equations was also presented. Several flows with incompressible analytic solutions were computed. Excellent results were obtained on Rankine ovoids and ovals, Joukowsky airfoils, and other geometries. Compressible results agreed well with Gothert's rule compressibility corrections. Dissert. Abstr.

N79-18905 Oklahoma State Univ., Stillwater.
MEASUREMENTS ON THE FLOW AND ACOUSTIC PROPERTIES OF A MODERATE REYNOLDS NUMBER SUPERSONIC JET Ph.D. Thesis
Timothy Ray Troutt 1978 108 p
Avail: Univ. Microfilms Order No. 7903753

Mean flow properties of a moderate Reynolds number (Re = 70,000), M = 2.1 axisymmetric cold air jet were measured with Pitot and static pressure probes and with hot-wire probes. Flow fluctuation measurements were made with hot-wire probes. Acoustic radiation measurements were made with condenser microphones. Flow and acoustic measurements were also made with the jet artificially excited by an oscillating glow discharge. The flow fluctuations within the jet shear layer grow at a constant exponential rate of 2 1/2 to 3 jet diameters downstream of the nozzle exit. Non-linear effects then become apparent with increased growth rates at lower frequencies and damped growth rates for higher frequency fluctuations. The noise produced by the jet has a broad spectral distribution. The content of the spectra shifts to lower frequencies with increased downstream position. Dissert. Abstr.

N79-18906 North Carolina State Univ. at Raleigh.
THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER ON A SPINNING CONE AT ANGLE OF ATTACK Ph.D. Thesis
Charles Phillip Ford, III 1978 149 p
Avail: Univ. Microfilms Order No. 7820061

The boundary layer had no effect on the inviscid flow and the inviscid flow was used as the outer boundary condition for the boundary layer equations. A momentum integral technique was used to reduce the governing equations to two. The two resulting partial differential equations were then solved by an implicit finite-difference technique of the marching type. This method is stable and accurate and fairly insensitive to the step size used in the finite-difference method. Computer solutions are found in the cases where spin rate produces surface velocity at the base of the cone less than the free stream velocity. Test cases are run with a free stream velocity of 60.96 meters per second with a cone half angle of 10 degrees. Angle of attack is either zero or five degrees with spin rates of 0, 400, 500 revolutions per minute. Typical execution times are less than four minutes on an IBM 370/165 computer.Dissert. Abstr.

N79-18907 Iowa State Univ. of Science and Technology, Ames.
ON IMPROVING THE ITERATIVE CONVERGENCE PROPERTIES OF AN IMPLICIT APPROXIMATE-FACTORIZATION FINITE-DIFFERENCE ALGORITHM Ph.D. Thesis
Jean-Antoine Desideri 1978 119 p
Avail: Univ. Microfilms Order No. 7903969

The iterative convergence properties of currently popular approximate-factorization implicit finite-difference algorithm were analyzed both theoretically and numerically. Modifications to the base algorithm were made to remove the inconsistency in the original implementation of artificial dissipation. In this way, the steady-state solution became independent of the time-step, and much larger time-steps could be used stably. To accelerate the iterative convergence, large time-steps and a cyclic sequence of time-steps were used. For a model transonic flow problem governed by the Euler equations, convergence was achieved with 10 times fewer time-steps with the modified differencing scheme. Finally, a particular form of instability due to variable coefficients was also analyzed. Dissert. Abstr.

N79-18908 Virginia Polytechnic Inst. and State Univ., Blacksburg.
EXPERIMENTAL INVESTIGATION OF UNSTEADY SEPARATION Ph.D. Thesis
Constantinos Angelos Koromilas 1978 138 p
Avail: Univ. Microfilms Order No. 7904152

The design of most aerodynamic surfaces, as for example the helicopter rotor, was based essentially on quasi-steady theories. However, the dynamics of a rotating blade introduced unexpected fluctuations and overshoots of properties like lift, drag, etc. The phenomenon of unsteady stall was intimately connected with the development of an oscillating boundary layer and separation. Experimental investigation of such flows was undertaken by a method of visualization developed especially for the study of laminar or turbulent boundary layers and separation. The method captured the instantaneous 2-D flow field including regions of separated flow and provided accurate quantitative information. Laser doppler anemometer measurements complemented the optically received data. Results revealed that separation responds with time-lag to external disturbances, in agreement with unsteady stall data.
Dissert. Abstr.

N79-18909 Iowa State Univ. of Science and Technology, Ames.
CALCULATION OF SUPERSONIC VISCOUS FLOW OVER DELTA WINGS WITH SHARP SUBSONIC LEADING EDGES Ph.D. Thesis
Yvon Clovis Vigneron 1978 79 p
Avail: Univ. Microfilms Order No. 7904026

Two complementary procedures were developed to calculate the viscous supersonic flow over conical shapes at large angles of attack, with application to cones and delta wings. In the first approach, the flow was assumed to be conical and the governing equations were solved at a given Reynolds number with a time-marching explicit finite difference algorithm. In the second method the parabolized Navier-Stokes equations were solved with a space-marching implicit noniterative finite difference algorithm. This latter approach was not restricted to conical shapes and provided a large improvement in computational efficiency over published methods. Results from the two procedures agree very well with each other and with available experimental data.
Dissert. Abstr.

N79-18910 Colorado Univ. at Boulder.
UNSTEADY BOUNDARY LAYER FLOW REVERSAL IN A LONGITUDINALLY OSCILLATING FLOW Ph.D. Thesis
John Powers Retelle, Jr. 1978 144 p
Avail: Univ. Microfilms Order No. 7903083

This experiment was conducted to provide information which would lead to a better understanding of the onset of unsteady flow reversal in attached and separated boundary layers. It was shown that boundary layer flow reversal on a stationary airfoil in an oscillating free stream responded to changes in the flow unsteadiness in a manner similar to the flow reversal noted during the onset of dynamic stall on an airfoil oscillating in pitch. Measurements of boundary layer flow reversal made in a wind tunnel on a stationary NACA 0012 airfoil immersed in a longitudinally oscillating subsonic flow are described. A split-film sensor provided flow reversal data in regions above the airfoil surface throughout the period of flow oscillation. At angles of attack below the steady-flow stall angle of attack and for small amplitude oscillations, regions of boundary layer flow reversal

near the leading edge were observed to vary nominally in phase with the time-varying external velocity. Dissert. Abstr.

N79-18911 Engineering Sciences Data Unit, London (England).
ACROSS-FLOW RESPONSE DUE TO VORTEX SHEDDING: ISOLATED CIRCULAR CYLINDRICAL STRUCTURES IN WIND OR GAS FLOWS
Oct. 1978 59 p
(ESDU-78006; ISBN-0-85679-229-2) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn.: ESDU, Springfield, Va. 22161

Data is presented for estimating the maximum oscillation amplitudes induced by vortex shedding on flexible structures and the critical flow speeds at which they occur. This information is also important in the fatigue analysis of a structure. Only isolated structures of circular cross section are treated. ESDU

N79-18912 Engineering Sciences Data Unit, London (England).
THE INFLUENCE OF BODY GEOMETRY AND FLOW CONDITIONS ON AXISYMMETRIC VELOCITY DISTRIBUTIONS AT SUBCRITICAL MACH NUMBERS
Oct. 1978 17 p Supersedes ESDU/A/B-000301
(ESDU-78037; ISBN-0-85679-241-1; ESDU/A/B-000301) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161

The effect of body geometry and flow conditions on the velocity distribution over axisymmetric bodies is developed. ESDU

N79-18913 Engineering Sciences Data Unit, London (England).
TRANSONIC BASE AND BOAT-TAIL PRESSURE DRAG OF CYLINDRICAL BODIES WITH CONICAL BOAT-TAILS
Nov. 1978 28 p
(ESDU-78041; ISBN-0-85679-245-4; ISSN-0141-397X) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC E99

A purely empirical method is provided for estimating the base and boat-tail pressure drag coefficients of cylindrical bodies with conical boat-tailing for the Mach number range 0.9 less than or equal to 1.3. The method is purely empirical. The bodies considered are at zero incidence and are axisymmetric, with long cylindrical midbodies immediately in front of the boat-tailing. It is assumed that the boundary layer is turbulent and that there is no jet flow through the base. The majority of the data was obtained from wind-tunnel tests. Some data is taken from free-flight on bodies without stabilizing fins. ESDU

N79-18914*# National Aeronautics and Space Administration, Washington, D. C.
VORTEX PATTERN DEVELOPMENT ON THE UPPER SURFACE OF A SWEPT WING AT HIGH ANGLE OF ATTACK
J. Mirande, V. Schmitt, and H. Werle Mar. 1979 35 p refs Transl. into ENGLISH of Conf. paper from ONERA, Paris Presented at AGARD. Reunion sur l'Aerodynamique des Grandes Incidences, Sandefjord, Norway, 4-6 Oct. 1978 Original language document was announced as A79-18554 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75377; ONERA-TP-1978-124; Memoire-12) Avail: NTIS HC A03/MF A01 CSCL 01A

An experimental study, based on a swept wing, was undertaken in the water tunnel and the wind tunnel at low speeds, with a view to improving the understanding of the intervening phenomena and to make easier their modelling. The vortex flow effects on the wing are first illustrated from global effort measurements and static pressure distributions. The domain of existence of this type of flow is deduced as a function of both sweep angle and angle of attack. By a phenomenological study in the water tunnel, an attempt is made to describe the physical pattern of the vortex flow, from its formation near the apex to its breakdown at the trailing edge. Lastly, by means of a clinometric probe, the flow field over the wing is determined. L.S.

N79-18915*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPROXIMATION CONCEPTS FOR NUMERICAL AIRFOIL OPTIMIZATION
Garret N. Vanderplaats Mar. 1979 38 p refs
(NASA-TP-1370; A-7682) Avail: NTIS HC A03/MF A01 CSCL 01A

An efficient algorithm for airfoil optimization is presented. The algorithm utilizes approximation concepts to reduce the number of aerodynamic analyses required to reach the optimum design. Examples are presented and compared with previous results. Optimization efficiency improvements of more than a factor of 2 are demonstrated. Improvements in efficiency are demonstrated when analysis data obtained in previous designs are utilized. The method is a general optimization procedure and is not limited to this application. The method is intended for application to a wide range of engineering design problems. S.E.S.

N79-18916*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INERTIAL DYNAMICS OF A GENERAL PURPOSE ROTOR
Ronald W. DuVal Mar. 1979 34 p refs
(NASA-TM-78557; A-7731) Avail: NTIS HC A03/MF A01 CSCL 01A

The inertial dynamics of a fully articulated stiff rotor blade are derived with emphasis on equations that facilitate an organized programming approach for simulation applications. The model for the derivation includes hinge offset and six degrees of freedom for the rotor shaft. Results are compared with the flapping and lead-lag equations currently used in the Rotor Systems Research Aircraft simulation model and differences are analyzed. Author

N79-18917*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
ANALYSIS OF SOME AERODYNAMIC CHARACTERISTICS DUE TO WING-JET INTERACTION
Greg L. Fillman and C. Edward Lan Mar. 1979 126 p refs (Grant NsG-1139)
(NASA-CR-158349; CRINC-FRL-281-4) Avail: NTIS HC A07/MF A01 CSCL 01A

The results of two separate theoretical investigations are presented. A program was used which is capable of predicting the aerodynamic characteristics of both upper-surface blowing (USB) and over-wing blowing (OWB) configurations. A theoretical analysis of the effects of over-wing blowing jets on the induced drag of a 50 deg sweep back wing was developed. Experiments showed net drag reductions associated with the well known lift enhancement due to over-wing blowing. The mechanisms through which this drag reduction is brought about are presented. Both jet entrainment and the so called wing-jet interaction play important roles in this process. The effects of a rectangular upper-surface blowing jet were examined for a wide variety of planforms. The isolated effects of wing taper, sweep, and aspect ratio variations on the incremental lift due to blowing are presented. The effects of wing taper ratio and sweep angle were found to be especially important parameters when considering the relative levels of incremental lift produced by an upper-surface blowing configuration. M.M.M.

N79-18918# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
MISSILE AERODYNAMICS, VOLUME 1
1976 529 p refs Lecture held at Rhode Saint Genese, Belgium, 29 Mar. - 2 Apr. 1976 2 Vol.
(VKI-Lecture-Series-88-Vol-1) Avail: NTIS HC A23/MF A01

The differences in flight conditions and geometric configurations between aircraft and missile mean that aerodynamic techniques for missile applications frequently differ from those used for aircraft. This lecture series aimed to emphasize these differences in the aerodynamic design features of both guided and unguided weapons. In addition to treating the component parts of weapons themselves, (e.g. wings, bodies, controls) and particular aspects of complete weapons (e.g., kinetic heating, high incidence effects), the course also dealt with the place of aerodynamics in the missile design process, the effect of airbreathing propulsion units, the interaction between aircraft and the weapons they carry, and model test techniques. For individual titles, see N79-18919 through N79-18926.

N79-18919# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
A BRIEF REVIEW OF AIR-FLIGHT WEAPONS
G. G. Brebner *In* Von Karman Inst. for Fluid Dyn. Missile Aerodon., Vol. 1 1976 37 p (For primary document see N79-18918 10-02)
Avail: NTIS HC A23/MF A01

After a brief summary of air-flight weapons history the following topics are discussed: (1) categories of weapons; (2) classes of guided weapons; (3) components of missile design; and (4) the process of aerodynamic design of a weapon. Drawings of the various types of missiles and weapons are presented. G.Y.

N79-18920# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
GENERAL WEAPON AERODYNAMICS
G. G. Brebner *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 1 1976 44 p refs (For primary document see N79-18918 10-02)
Avail: NTIS HC A23/MF A01

The main aerodynamic effects, coefficients and derivatives which are important in the design of weapons are considered, and in broad terms some of the methods that may be used to estimate their values are indicated. No particular aspect is treated in depth or are any comprehensive set of equations that may be used given. A brief discussion of aerodynamic characteristics (wing-body and wing-tail interference, base pressure) is given. G.Y.

N79-18921# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
WINGS
W. Stahl *In its* Missile Aerodyn., Vol. 1 1976 62 p refs (For primary document see N79-18918 10-02)
Avail: NTIS HC A23/MF A01

Material is presented on low aspect ratio wings to provide an insight into the flow field and to discuss some of the effects of the flow on the wing. Experimental evidence, as obtained in wind tunnels by various flow visualization techniques and from pressure meaurements made on the model surfaces or in the outer flow are used to help in designing a wing with some desired properties. Some results of force measurements are presented to give an idea of the aerodynamic characteristics of such wings. A short survey is also given on some of the better known theoretical methods for the prediction of the aerodynamic characteristics of wings. Results obtained from some of the theories are compared to the results from experiments. G.Y.

N79-18922# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewande Gasdynamik.
BODIES
H. Esch *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 1 1976 82 p refs (For primary document see N79-18918 10-02)
Avail: NTIS HC A23/MF A01

The determination of the static aerodynamic coefficients of axisymmetric bodies is discussed. According to physical aspects the forces are decomposed into potential flow, friction, and separated flow. For each of these 3 types of flow different computational methods must be applied. Only relatively simple methods are discussed which allow a quick estimation of the aerodynamics. In most cases only slender shapes can be treated by these methods. The problems which arise from the bluntness are also discussed. The Reynolds numbers of the windtunnel models and of the real missiles are often different and this difference may have an influence on the aerodynamic coefficients. The influence of the Reynolds number is also discussed. G.Y.

N79-18923# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
THE CONSIDERATION OF WING-BODY AND WING-TAIL INTERFERENCE IN MISSILE-DESIGN
Gregor Gregoriou *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 1 1976 59 p refs (For primary document see N79-18918 10-02)
Avail: NTIS HC A23/MF A01

The interference between wing and body and between wing and tail is of great importance for the design of a missile, particularly for the determination of the longitudinal stability. Apart from the explanation of the mechanism of these interferences further methods for the quantitative determination of interference are discussed, among others, methods that were developed in the past few years. Possibilities of determining aerodynamic coefficients as well as the accuracy of existing computing methods are demonstrated by means of examples. G.Y.

N79-18924# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE CONTROL OF GUIDED WEAPONS
G. G. Brebner *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 1 1976 75 p refs (For primary document see N79-18918 10-02)
Avail: NTIS HC A23/MF A01

The lecture is divided into two parts, the first being concerned with control by deflecting aerodynamic surfaces, the second with other forms of control. The first part includes all-moving surfaces at the tail and nose, moving wings, trailing edge and wing-tip controls. In general, cruciform configurations will be studied. The second part deals with spoilers, jet reaction control and thrust vector control. G.Y.

N79-18925# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
AIRBREATHING ENGINES - AERODYNAMIC ASPECTS
Guenther Jungclaus *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 1 1976 40 p refs (For primary document see N79-18918 10-02)
Avail: NTIS HC A23/MF A01

The interrelation between air inlet and the engine and the types of inlet are discussed. Air inlet design is discussed with respect to: flow modes, flow around the cowl, mass flow vs. pressure relationship, starting conditions, efficiency definitions and multiple-shock diffusers. Some special problems dealing with interference, angle of attack and nonstationary flow are presented. G.Y.

N79-18926# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Mechanical and Industrial Engineering.
ANALYSIS OF BASE-FLOW PROBLEMS DURING POWERED SUPERSONIC FLIGHT
A. L. Addy *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 1 1976 100 p refs (For primary document see N79-18918 10-02)
Avail: NTIS HC A23/MF A01

At supersonic flight speeds, aircraft and missile performance during powered flight can be significantly affected by the separated flow region formed at the base of the vehicle by the interaction between the freestream and propulsive-nozzle flows. The proper evaluation of the effects of this separated-flow region, the base-flow region, is a difficult and recurring problem in aerodynamic design. Due to the generality, flexibility, and potential for extension, the Chapman-Korst component model provides a means for the qualitative and quantitative evaluation of the effect on the afterbody-base problem of all pertinent design and performance parameters. The object of these notes is to present the theoretical bases for the generalized Chapman-Korst model, to demonstrate the capabilities and limitations of the model, to compare experimental and theoretical results, and to discuss areas requiring further development. G.Y.

N79-18927# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
MISSILE AERODYNAMICS, VOLUME 2
2 Apr. 1976 546 p refs Lecture held at Rhode Saint Genese, Belgium, 29 Mar. - 2 Apr. 1976 2 Vol.
(VKI-Lecture-Series-88-Vol-2) Copyright. Avail: NTIS HC A23/MF A01

Volume 2 of this two volume lecture series is presented. Topics of discussion include: (1) aerodynamic characteristics of complete configurations; (2) high angle of attack aerodynamics; (3) weapon aircraft interactions; (4) kinetic heating; (5) model test techniques; and (6) the place of aerodynamics in the design process. For individual titles, see N79-18928 through N79-18933.

N79-18928# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

AERODYNAMIC CHARACTERISTICS OF COMPLETE CONFIGURATIONS

H. Barth *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 2 1976 133 p refs (For primary document see N79-18927 10-02)

Avail: NTIS HC A23/MF A01

The various design configurations open to the designer, together with their associated advantages and disadvantages, are discussed and described. This paper is restricted primarily to the aerodynamic design considerations. The very fundamentals of the flow mechanism, the theoretical approach to slender configurations and outstanding design features such as maneuverability, static stability and their interaction are briefly discussed. Emphasis was put upon the aim of this lecture series, namely, to give junior aerodynamicists and nonaerodynamicists a survey of aerodynamic design aspects. G.Y.

N79-18929# Naval Surface Weapons Center, White Oak, Md. Experimental Aerodynamics Branch.

HIGH-ANGLE-OF-ATTACK AERODYNAMICS

Andrew B. Wardlaw, Jr. *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 2 1976 144 p refs (For primary document see N79-18927 10-02)

Avail: NTIS HC A23/MF A01

The lecture notes are divided into two sections. The first section deals with information on missiles at high angles of attack. It includes a discussion of induced loads and a study of the high-incidence flow field. The second section provides an overview of existing predictive methods. The discussion is divided into sections covering bodies alone, wings alone, and complete configurations. Each of these subjects is further broken down into empirical, semiempirical and analytical methods. G.Y.

N79-18930# Royal Aircraft Establishment, Farnborough (England).

WEAPON/AIRCRAFT INTERACTIONS

G. G. Brebner *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 2 1976 43 p refs (For primary document see N79-18927 10-02)

Copyright. Avail: NTIS HC A23/MF A01

Some of the main constraints placed on the geometry of weapons arise from their environment before they are launched or released. In this lecture only aerodynamic aspects of weapon/aircraft interactions are discussed. These are divided into three topics: (1) the drag of the aircraft/weapon combination; (2) the other carriage loads acting on the weapon during carriage; and (3) the disturbances experienced by the weapon after release or launch. G.Y.

N79-18931# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

KINETIC HEATING

B. F. Richards *In its* Missile Aerodyn., Vol. 2 1976 36 p refs (For primary document see N79-18927 10-02)

Avail: NTIS HC A23/MF A01

A review of relevant accessible publications to help missile aerodynamicists to assess the importance of kinetic heating to a particular design is presented. The elements of a design calculation are outlined. Flow situations in which kinetic heating is most likely to be a problem are outlined. A review of prediction methods for attached flow situations is presented. Heat transfer involved with flow interactions are discussed. Some applications to configurations are also presented. Some remarks on wind tunnel facilities for simulating aerodynamic heating are given. G.Y.

N79-18932# Royal Aircraft Establishment, Bedford (England).

MODEL TEST TECHNIQUES

J. B. Ogle *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 2 1976 28 p refs (For primary document see N79-18927 10-02)

Avail: NTIS HC A23/MF A01

By far the most important and widely used instrument for aerodynamic testing is the wind tunnel. This lecture is devoted to them and a survey of their applications. Much of the content of this lecture pertains to wind tunnel testing in general, but emphasis is given to particular features which are important to missile aerodynamics. The following topics are discussed: (1) wind tunnel hardware; (2) force testing; (3) pressure measurement; (4) flow visualization; (5) jet efflux simulation; (6) carriage loads and store release; and (7) dynamic testing. G.Y.

N79-18933# Hawker Siddeley Dynamics Ltd., Hatfield (England). Naval Weapons Div.

THE PLACE OF AERODYNAMICS IN THE DESIGN PROCESS

J. I. Haworth *In* Von Karman Inst. for Fluid Dyn. Missile Aerodyn., Vol. 2 1976 143 p (For primary document see N79-18927 10-02)

Avail: NTIS HC A23/MF A01

The subject of how aerodynamics is dealt with in its practical application to missile design and development is the aim of this lecture. An explanation of the main stages involved in the inception and growth of a major project is given and the underlining principles which govern the whole of the design and development work is explained. It is shown how the aerodynamic requirements are derived from the overall missile design and performance requirements. The steps taken to meet these requirements, leading to the specification of the aerodynamic characteristics, and the verification of these, are outlined. In general, this lecture aims at stating what the aerodynamicist has to do, and why these tasks arise. G.Y.

N79-18934# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

COMPRESSIBLE TURBULENT BOUNDARY LAYERS, VOLUME 1

1976 388 p refs Lecture held at Rhode Saint Genese, Belgium, 1-5 Mar. 1976 2 Vol.

(VKI-Lecture-Series-86-Vol-1) Avail: NTIS HC A17/MF A01

Information about some specific topics of compressible turbulent boundary layers is presented. The accurate measurement of compressible turbulent layers for a good base for checking calculation methods is provided. For individual titles, see N79-18935 through N79-18938.

N79-18935# Technische Univ., Berlin (West Germany).

COMPRESSIBLE TURBULENT BOUNDARY LAYERS, INTRODUCTION

H. H. Fernholz *In* Von Karman Inst. for Fluid Dyn. Compressible Turbulent Boundary Layers, Vol. 1 1976 65 p refs (For primary document see N79-18934 10-02)

Avail: NTIS HC A17/MF A01

Steady two-dimensional boundary layers are discussed. When dealing with compressible turbulent boundary layers two questions arise: What are the dominating parameters of the flow problem and, how is the turbulence field affected by the high-speed flow effects. S.E.S.

N79-18936# Royal Aircraft Establishment, Bedford (England).

NOTES ON THE MEASUREMENT OF AERODYNAMIC HEAT TRANSFER IN MODEL-TESTING FACILITIES

K. G. Winter *In* Von Karman Inst. for Fluid Dyn. Compressible Turbulent Boundary Layers, Vol. 1 1976 51 p refs (For primary document see N79-18934 10-02)

Avail: NTIS HC A17/MF A01

The experimental arrangements required to enable heat transfer measurements to be made in both short-duration are reviewed, and continuously-operated aerodynamic test facilities and of the measuring techniques employed. S.E.S.

N79-18937# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

MEASURING TECHNIQUES FOR COMPRESSIBLE TURBULENT BOUNDARY LAYERS

H. U. Meier *In* Von Karman Inst. for Fluid Dyn. Compressible Turbulent Boundary Layers, Vol. 1 1976 73 p refs (For primary document see N79-18934 10-02)

Avail: NTIS HC A17/MF A01

Probes for the measurement of mean flow quantities like total and static pressure, total temperature and mass flow in supersonic turbulent boundary layers were surveyed. Their special applications as well as their shortcomings are pointed out. Possible

probe corrections which should be applied under particular flow conditions are discussed. Hot wire and Laser Doppler anemometer are described. The application of these measuring techniques for the determination of velicity, mass flow and total temperature fluctuations is shown and results of measurements are reported.
S.E.S.

N79-18938# Louvain Univ. (Belgium). Dept. of Civil Engineering.
SURVEY OF MEASUREMENT TECHNIQUES FOR TURBULENT BOUNDARY LAYERS IN SHORT DURATION HYPERSONIC WIND TUNNELS
Edgard Backx *In* Von Karman Inst. for Fluid Dyn. Compressible Turbulent Boundary Layers, Vol. 1 1976 46 p refs (For primary document see N79-18934 10-02)
Avail: NTIS HC A17/MF A01

The development of hypersonic wind tunnels and a short overview of the reasons which led to the use of short duration facilities were reviewed. Some properties that were imposed on the instruments and some characteristics of hypersonic turbulent boundary layers are discussed. A sample list of different techniques used to measure mean flow properties is given. The measurement of stagnation temperature is presented. The turbulence model used at very high Mach number boundary layers is reported.
S.E.S.

N79-18939# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPRESSIBLE TURBULENT BOUNDARY LAYERS, VOLUME 2
1976 269 p refs Proc. of lecture series held 1-5 Mar. 1976 (VKI-Lecture-Series-86-Vol-2) Avail: NTIS HC A12/MF A01

The turbulence structure of compressible boundary layers, calculation methods for compressible turbulent boundary layers, and shock boundary layer interactions are discussed. For individual titles, see N79-18940 through N79-18942.

N79-18940# Imperial Coll. of Science and Technology, London (England).
THE TURBULENCE STRUCTURE OF COMPRESSIBLE BOUNDARY LAYERS
P. Bradshaw *In* Von Karman Inst. for Fluid Dyn. Compressible Turbulent Boundary Layers, Vol. 2 1976 48 p refs (For primary document see N79-18939 10-02)
Avail: NTIS HC A12/MF A01

Morkovin's hypothesis, that turbulence is unaffected by density fluctuations if they are small compared to the mean density, is presented and discussed. The Van Driest (mixing-length) transformation is derived and used to discuss compressibility effects on mean velocity profiles. The turbulence structure of hypersonic boundary layers is discussed, with particular reference to the changes in intermittency in the outer layer and to the eventual breakdown of local-similarity arguments in the inner layer. Pressure fluctuations are provided for a simple check on Morkovin's hypothesis. Low-Reynolds-number effects, which contaminate most of the existing data at hypersonic speeds, are presented, with some speculations about their relation to intermittency behavior. The effects of perturbations on the turbulence structure are described.
S.E.S.

N79-18941*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CALCULATION METHODS FOR COMPRESSIBLE TURBULENT BOUNDARY LAYERS
Dennis M. Bushnell, Aubrey M. Cary, Jr., and Julius E. Harris *In* Von Karman Inst. for Fluid Dyn. Compressible Turbulent Boundary Layers, Vol. 2 1976 124 p refs (For primary document see N79-18939 10-02)
Avail: NTIS HC A12/MF A01 CSCL 01A

Calculation procedures for non-reacting compressible two- and three-dimensional turbulent boundary layers were reviewed. Integral, transformation and correlation methods, as well as finite difference solutions of the complete boundary layer equations summarized. Alternative numerical solution procedures were examined, and both mean field and mean turbulence field closure models were considered. Physics and related calculation problems peculiar to compressible turbulent boundary layers are described. A catalog of available solution procedures of the finite difference, finite element, and method of weighted residuals genre is included. Influence of compressibility, low Reynolds number, wall blowing, and pressure gradient upon mean field closure constants are reported.
S.E.S.

N79-18942# Air Force Academy, Colo.
SHOCK-BOUNDARY LAYER INTERACTION
Gordon C. Oates *In* Von Karman Inst. for Fluid Dyn. Compressible Turbulent Boundary Layers, Vol. 2 1976 77 p refs (For primary document see N79-18939 10-02)
Avail: NTIS HC A12/MF A01

The interactions between a shock wave and a boundary layer were investigated. The intense interest in this class of interactions reflected the great significance of the interactions in many engineering application. Examples of such interactions include the interactions of experienced in supersonic inlets and transonic flow over a wing. Boundary layer calculation methods, compound flow theory, and supercritical boundary layer are discussed.
S.E.S.

N79-18943# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPUTATIONAL FLUID DYNAMICS, VOLUME 1
1976 428 p refs Lecture held at Rhode Saint Genese, Belgium, 15-19 Mar. 1976 2 Vol.
(VKI-Lecture-Series-87-Vol-1) Avail: NTIS HC A19/MF A01

Recent advances in the application of numerical methods to the solution of fluid dynamics problems are reviewed and the future prospects of such methods are assessed. Topics cover progress in transonic flow computations, solving Navier-Stokes equations in physiological flows, and using the finite element method in fluid dynamics problems. For individual titles, see N79-18944 through N79-18947.

N79-18944*# New York Univ., N. Y. ERDA Mathematics and Computing Lab.
TRANSONIC FLOW CALCULATIONS
Antony Jameson *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1976 136 p refs (For primary document see N79-18943 10-02)
(Grants NGR-33-016-167; NGR-33-016-201; Contract E(111-1)-3077)
Avail: NTIS HC A19/MF A01 CSCL 01A

The development of relaxation methods to calculate transonic flows is discussed. Rather accurate predictions can be made for a number of flows of interest using the transonic potential flow equation, which may be derived from the Euler equations for inviscid compressible flow by introducing the assumption that the flow is irrotational. Once the choice of a mathematical model has been settled, the numerical procedure for actually computing a solution contains two main elements: the construction of a discrete approximation which converges to the solution of the continuous problem in the limit as the mesh width is reduced to zero, and the solution of the resulting set of nonlinear difference equations by a convergent iterative scheme. The choice of an appropriate coordinate system and its influence on the accuracy of the discrete approximation is discussed. Several applications of the general method are described.
A.R.H.

N79-18945# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
APPLICATION OF NUMERICAL METHODS TO PHYSIOLOGICAL FLOWS c52
Thomas J. Mueller *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1976 95 p refs Sponsored in part by Am. Heart Assoc. and NSF (For primary document see N79-18943 10-02)
Avail: NTIS HC A19/MF A01

Finite difference numerical methods are applied to the Navier-Stokes equations for problems related to axisymmetric heart valves and planar and axisymmetric local vessel constriction. The favorable comparison of these techniques with experimental results permits their use in the study of complicated unsteady separated flow phenomena which are difficult to produce and study in physical experiments.
A.R.H.

N79-18946*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SOME RECENT PROGRESS IN TRANSONIC FLOW COMPUTATION

William F. Ballhaus *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1976 122 p refs (For primary document see N79-18943 10-02)
Avail: NTIS HC A19/MF A01 CSCL 01A

Although the development of a finite difference relaxation procedure to solve the steady form of equations of motion gave birth to the study of computational transonic aerodynamics and considerable progress has been made using the small disturbance theory, no general analytical solution method yet exists for transonic flows that include three dimensional unsteady, and viscous effects. Two techniques are described which are useful in computational transonic aerodynamics applications. The finite volume method simplifies the application of boundary conditions without introducing the constriction associated with small disturbance theory. Governing equations are solved in a Cartesian coordinate system using a body-oriented and shock-oriented mesh network. Only the volume and surface normal directions of the volume elements must be known. The other method, configuration design by numerical optimization, can be used by aircraft designers to develop configurations that satisfy specific geometric performance constraints. Two examples of airfoil design by numerical optimization are presented. A.R.H.

N79-18947# Vrije Universiteit, Brussels (Belgium).

INTRODUCTION TO THE FINITE ELEMENT METHOD AND ITS APPLICATION IN FLUID MECHANICS c34

Ch. Hirsch *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1976 55 p refs (For primary document see N79-18943 10-02)
Avail: NTIS HC A19/MF A01

The principles of the finite element method are presented with emphasis on fluid mechanical problems. The method of weighted residuals is particularly adapted and leads to the formulation of an integral functional, in association with the method of Galerkin. The application to the general transport equation of fluid mechanics is given as an example. The most usual elements and their associated shape functions are summarized and the definition of isoparametric curved elements is introduced. A finite element program for the calculation of the meridional through-flow in a turbomachine is described. A.R.H.

N79-18948# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

COMPUTATIONAL FLUID DYNAMICS, VOLUME 2

1976 432 p refs Lecture held at Rhode Saint Genese, Belgium, 15-19 Mar. 1976 2 Vol.
(VKI-Lecture-Series-87-Vol-2) Avail: NTIS HC A19/MF A01

Applications of the finite element, panel, and relaxation methods in fluid dynamics are described with emphasis on aerodynamic configurations and the airfoil design. The current and future status of computational fluid dynamics is assessed by the director of astronautics at NASA-Ames and a member of the Moscow Academy of Sciences computing center. For individual titles, see N79-18949 through N79-18953.

N79-18949# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

APPLICATION OF THE FINITE-ELEMENT METHOD IN NON-LINEAR AERODYNAMICS

P. Perrier and J. Periaux *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1976 51 p refs (For primary document see N79-18948 10-02)
Avail: NTIS HC A19/MF A01

The two major areas of interest in nonlinear aerodynamics involve the study of viscous layers particularly with reverse flows (separated flows) and inviscid subsonic-supersonic flows with embedded shock-waves (transonic flows). Coupling nonlinear viscous and inviscid flows requires the flexibility in boundary conditions which the finite element method can afford. A.R.H.

N79-18950# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

PANEL METHODS IN AERODYNAMICS

Werner Kraus *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1976 48 p refs (For primary document see N79-18948 10-02)
Avail: NTIS HC A19/MF A01

Although the computation of flow fields around arbitrary shaped bodies in 2- or 3-dimensional flow using the potential theory is well known, the exact or approximate solution of the integral equation for a body with any given contour still poses a number of difficulties. A break through for the solution of the potential equation for bodies with any given contour was achieved by the so-called panel method. Instead of a continuous distribution of singularities on the surface of the body, the singularity strength on a particular surface element (panel) is given by a function. The intent is to solve the integral equation for the function of each panel. In order to fulfill the boundary condition, each panel received an assigned control point. By fulfilling all boundary conditions, the singularity strengths and thereby the flow field can be determined. This principle of panel methodology is explained. A.R.H.

N79-18951# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Theoretical Aerodynamics Group.

PROGRESS IN TRANSONIC FLOW COMPUTATIONS ANALYSIS AND DESIGN METHODS FOR THREE-DIMENSIONAL FLOWS

Wolfgang Schmidt *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1976 56 p refs (For primary document see N79-18948 10-02)
Avail: NTIS HC A19/MF A01

The difference schemes used for the evaluation of supercritical transonic wings and wing-body combinations at Dornier are described and compared with those used in relaxation methods elsewhere. Special attention is given to different assumptions made because of the small perturbation form of the equations. A flow chart of the analysis and design system is presented which shows how the use of different blocks minimizes the input information needed. The possible procedure to be used in designing a new configuration is illustrated, including the proof of the off-design behavior and the check on possible constraints. A.R.H.

N79-18952*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STATUS AND PROSPECTS OF COMPUTATIONAL FLUID DYNAMICS

Dean R. Chapman *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1976 36 p (For primary document see N79-18948 10-02)
Avail: NTIS HC A19/MF A01 CSCL 01A

The use and limitations on using computational aerodynamics in approximating inviscid linear, inviscid nonlinear, vicous time averaged, and viscous time dependent flow past airfoils, wings, and aircraft is reviewed. The current status of two- and three-dimensional time averaged Navier-Stokes equation is discussed and possible applications for the 1980 and 1985 to 1990 period is projected for three-dimensional applications. A.R.H.

N79-18953# Academy of Sciences (USSR), Moscow. Computing Center.

COMPUTATIONAL EXPERIMENT: DIRECT NUMERICAL SIMULATION OF COMPLEX GAS DYNAMICS FLOW ON THE BASIS OF EULER, NAVIER-STOKES AND BOLTZMANN MODELS (FUTURE PROSPECTS OF COMPUTATIONAL FLUID DYNAMICS)

Oleg M. Belotserkovskii *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1976 72 p refs (For primary document see N79-18948 10-02)
Avail: NTIS HC A19/MF A01

The basic principles of computational experiment are formulated and the results of the investigation of various gas dynamics problems of a complex internal structure are presented. Transonic regimes (over-critical flows including transition over sound velocity), flows with a jet 'injected' into the main stream, and diffraction problems are examined. Flows in separation zones in the wake of a body are studied both for the limit cases of flows and at various Reynolds numbers. Consideration of the problem of the structure of the shock wave provides an example of the motion of a rarefied gas at various Mach numbers in the

oncoming flow. A set of control tests is worked out for the estimation of calculation accuracy. A.R.H.

N79-18954# Virginia Polytechnic Inst. and State Univ., Blacksburg.
SUBSONIC AERODYNAMIC LOADS ON MISSILES Final Report, 1 Sep. 1975 - 31 Aug. 1978
A. H. Nayfeh and D. T. Mook 6 Nov. 1978 8 p refs
(Grant DAAG29-76-G-0034)
(AD-A061937; ARO-13164.4-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

Five computer programs have been developed to calculate potential flows over wings, bodies, and wing-wing and wing-body combinations. These programs are based on the vortex-lattice technique. They are not restricted by planform, aspect ratio and angle of attack as long as separation occurs from sharp edges and there is no vortex bursting. A main feature of these programs is the calculation of the shapes of the wakes. The unsteady version, which treats wing-flap systems, couples the nonlinear dynamics and aerodynamics. Author (GRA)

N79-18955# Naval Surface Weapons Center, Dahlgren, Va.
OGIVE CYLINDER MODIFIED FOR NEAR MINIMUM SIDE MOMENT Final Report
Peter Daniels Oct. 1978 53 p refs
(WF32301000)
(AD-A061791; NSWC/DL-TR-3873) Avail: NTIS HC A04/MF A01 CSCL 20/4

Bodies of revolution develop side moments at large angles of attack due to asymmetric vortices. Consequently, a composite Ogive cylinder model was designed in order to determine what modifications were necessary to suppress this moment. Low speed wind tunnel tests, in which the geometry of the model was systematically varied, revealed that a simple afterbody step down coupled with slight nose bluntness could reduce side moment by over 90% compared to the unmodified model. Conventional models were constructed in order to substantiate the results obtained with the composite model. Tests were conducted at three different velocities (85 mph, 120 mph, 140 mph). Large reduction in side moments (90% reductions) were obtained. Author (GRA)

N79-18956# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 8: FREQUENCY ANALYSES OF WAKE SINGLE FILM DATA, BASIC CONFIGURATION WAKE EXPLORATION Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 482 p refs
(Contract DAAJ02-77-C-0020)
(AD-A062013; USARTL-TR-78-23H-Vol-8) Avail: NTIS HC A21/MF A01 CSCL 01/3

This is the second of the three volumes of Volume VIII containing frequency spectrographs of the model helicopter hub/rotor wake velocities derived from the single-film velocity transducer data. This sub-volume deals with the wake characteristics of the baseline configurations. Author (GRA)

N79-18957# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
INVESTIGATION OF TORSION FREE WING TREND FLUTTER MODELS Final Report, 1 Feb. 1977 - 31 Aug. 1978
Henry T. Y. Yang and C. H. Wan 15 Sep. 1978 60 p refs
(Grant AF-AFOSR-3265-77; AF Proj. 2307)
(AD-A061942; AFOSR-78-1514TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

Four types of aluminum plate flutter models of a torsion free wing (TFW) were studied: (1) cantilever wing; (2) pitch restrained wing; (3) TFW with forward trim surface; and (4) TFW with aft trim surface. Models (3) and (4) included the effect of fuselage. Free vibration analyses were performed by using the finite element program NASTRAN. Generalized aerodynamic forces were computed by using the program LAT2D based on the subsonic lifting surface theory of Kussner. Flutter speeds and frequencies were predicted by using the program FLTTR based on the V-g method. The predicted flutter speeds were compared with available computed and tested results. The predicted flutter speeds for the four models were compared with each other and conclusions were made. To determine the designs that yielded higher flutter speeds, parametric studies were conducted by varying each of the six parameters: thickness parameter of the wing; thickness parameter of either trim surface; location of the wing pivot; length of the boom; swept angle of the wing; and swept angle of either trim surface. The effect of these parameters on the flutter speeds of models (3) and (4) were plotted as trend curves and discussions and conclusions were made. Author (GRA)

N79-18958# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 6-A: ONE-THIRD OCTAVE BAND SPECTROGRAMS OF WAKE SINGLE FILM DATA, BUILDUP TO BASELINE Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 303 p
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A061994; USARTL-TR-78-23F-Vol-6-A) Avail: NTIS HC A14/MF A01 CSCL 01/3

This is the first of the three volumes of Volume VI containing one-third octave band spectrographs of the model helicopter hub/rotor wake velocities derived from the single-film velocity transducer data. This sub-volume deals with the wake changes as the model is built up to the baseline configuration. Author (GRA)

N79-18959# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 8-C: FREQUENCY ANALYSES OF WAKE SINGLE FILM DATA, HUBCAPS AND AIR EJECTORS Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 286 p
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A061995; USARTL-TR-78-23H-Vol-8-C) Avail: NTIS HC A13/MF A01 CSCL 01/3

This is the third of the three volumes of Volume VIII containing frequency spectrographs of the model helicopter hub/rotor wake velocities derived from the single-film velocity transducer data. This sub-volume deals with the effects of hub caps and air ejector systems on wake velocities. Author (GRA)

N79-18899# Lockheed Aircraft Corp., Burbank, Calif.
THE U-2 STORY
Kenneth W. Weir *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 186-192 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

N79-18900# Society of Experimental Test Pilots, Lancaster, Calif.
FLIGHT OF THE DOUBLE EAGLE 2
Ben L. Abruzzo, Larry Newman, and Maxie L. Anderson *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 205-213 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N79-18960*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVALUATION OF A WAKE VORTEX UPSET MODEL BASED ON SIMULTANEOUS MEASUREMENTS OF WAKE VELOCITIES AND PROBE-AIRCRAFT ACCELERATIONS
Barbara J. Short and Robert A. Jacobsen Mar. 1979 42 p refs
(NASA-TM-78561; A-7735) Avail: NTIS HC A03/MF A01 CSCL 01C

Simultaneous measurements were made of the upset responses experienced and the wake velocities encountered by an instrumented Learjet probe aircraft behind a Boeing 747 vortex-generating aircraft. The vortex-induced angular accelerations experienced could be predicted within 30% by a mathematical upset response model when the characteristics of the wake were well represented by the vortex model. The vortex model used in the present study adequately represented the wake flow field when the vortices dissipated symmetrically and only one vortex pair existed in the wake. L.S.

N79-18961# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT: ALLEGHENY AIRLINES, INC. BAC 1-11, N1550, ROCHESTER, NEW YORK, JULY 9, 1978
8 Feb. 1979 52 p refs
(NTSB-AAR-79-2) Avail: NTIS HC A04/MF A01

After completing a precision approach and landing in visual flight conditions, the aircraft overran the end of the runway, crossed a drainage ditch and came to rest 728 ft past the end of the runway threshold. Although the aircraft was damaged substantially when it hit the drainage ditch, there was no fire. There were 73 passengers and a crew of 4 on board; one passenger was injured seriously. The probable cause of the accident was the captain's complete lack of awareness of airspeed, vertical speed, and aircraft performance throughout an ILS approach and landing in visual meteorological conditions which resulted in his landing the aircraft at an excessively high speed and with insufficient runway remaining for stopping the aircraft, but with sufficient aircraft performance capability to reject the landing well after touchdown. Contributing to the accident was the first officer's failure to provide required callouts which might have altered the captain to the airspeed and sink rate deviations. The Safety Board was unable to determine the reason for the captain's lack of awarness or the first officer's failure to provide required callouts. A.R.H.

N79-18962# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ANALYSIS OF THE FUNCTIONAL REQUIREMENTS FOR AN INTELLIGENT AIRBORNE COMPUTER SYSTEM M.S. Thesis
Ronald Itsuo Morishige 1978 49 p refs
(AD-A061649; AFIT-CI-79-8) Avail: NTIS HC A03/MF A01 CSCL 01/2

The use of artificial intelligence methods in an airborne computer system can enhance flight safety by reducing the possibility of pilot error caused by inadequate or misleading information. The intelligent computer system would have the ability to screen information for relevancy to the current situation. The selection of information requires knowledge of the context which may depend upon the phase of flight, the condition of the aircraft, or external factors. The phase-based context might be represented by scripts. The condition-based and the external context can be represented by a cause-effect net. Knowledge of context will not only enable priority resolution of information, but also definitions of goals for generating plans to cope with abnormal situations. Author (GRA)

N79-18963# General Accounting Office, Washington, D. C. Community and Economic Development Div.
COMMERCIAL SAFETY REGULATIONS ARE AVOIDED BY SOME LARGE AIRCRAFT OPERATORS
21 Nov. 1978 19 p ref
(PB-288833/7; CED-79-10) Avail: NTIS HC A02/MF A01 CSCL 01C

Several methods are used by some private operators of large aircraft to avoid compliance with commercial safety regulations, and, in some cases they may be operating unsafely. These operators pose a competitive threat to commercial operators who comply with more costly safety standards. The Federal Aviation Administration plans to strengthen safety regulations applicable to private large aircraft operations, making them more comparable to commercial regulations. All large aircraft would then be under similar standards, but there is a need to provide for routine Federal Aviation Administration access to privately operated large aircraft to monitor compliance with applicable regulations and discourage the transfer of aircraft registration to another country to avoid stiffer safety regulation. GRA

N79-19606# German Army Hospital, Munich (West Germany). Rescue Center.
RESCUE HELICOPTERS IN PRIMARY AND SECONDARY MISSIONS
B. Gorgass, G. Frey, W. Stotz, G. Kugler, and I. Karger *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 5 p refs Prepared in cooperation with Allgemeiner Deutscher Automobil-Club-e. V, Munich, West Ger. (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19607# Wood (William C.), Memphis, Tenn.
AEROMEDICAL EVACUATION ON THE PREDICTED EUROPEAN BATTLEFIELD: A SCENARIO IN URGENT NEED OF ATTENTION
William C. Wood *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 4 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19608# Maryland Inst. for Emergency Medical Services, Baltimore.
MARYLAND'S MED-EVAC HELICOPTER PROGRAM
R. Adams Cowley *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 8 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19610# Federal Armed Forces Medical Coll., Munich (West Germany).
COORDINATION OF MEDICAL ASPECTS OF THE AIR RESCUE SERVICE IN THE FEDERAL REPUBLIC OF GERMANY
H. J. Linde *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19611# Army Agency for Aviation Safety, Fort Rucker, Ala. Medical Div.
MEDICAL ASPECTS OF HELICOPTER EVACUATION AND RESCUE OPERATIONS
Daniel S. Berliner *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 3 p (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19613# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
THE BOAT THAT IS A RAFT
George P. Gillespie *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19614# Sikorsky Aircraft, Stratford, Conn. Dept. of Engineering.
UH-60A MEDEVAC KIT
Horace T. Hone *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19615# Societe Nationale Industrielle Aerospatiale, Marignane (France.) Helicopter Div.
CASUALTY EVACUATION BY HELICOPTER
Louis Vachon and Wilfrid Messens *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 18 p ref In ENGLISH and FRENCH (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19616# Canadian Armed Forces Base Hospital, Bushell Park (Saskatchewan).
DEVELOPMENT OF CASUALTY EVACUATION KIT FOR THE LIGHT OBSERVATION HELICOPTER (KIWA)
R. M. Goede *In* AGARD Operational Helicopter Aviation Med.

Dec. 1978 5 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19621# Army Aeromedical Research Lab., Fort Rucker, Ala.
US ARMY AVIATION FATIGUE-RELATED ACCIDENTS, 1971 - 1977
Gerald P. Krueger and Yvonna F. Jones *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19653# Michigan Univ., Ann Arbor. Inst. of Highway Safety Research.
OCCUPANT INJURY MECHANISMS IN CIVIL HELICOPTER ACCIDENTS
Richard G. Snyder *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 14 p refs Sponsored in part by FAA and NTSB (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19654# Army Agency for Aviation Safety, Fort Rucker, Ala.
COMPARATIVE INJURY PATTERNS IN US ARMY HELICOPTERS
Laurel D. Sand *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19655# Army Agency for Aviation Safety, Fort Rucker, Ala.
ENGINEERING ANALYSIS OF CRASH INJURY IN ARMY AIRCRAFT
James E. Hicks *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19658# Army Aviation Research and Development Command, Fort Eustis, Va. Applied Technology Lab.
CRASHWORTHY HELICOPTER SEATS AND OCCUPANT RESTRAINT SYSTEMS
George T. Singley, III and Stanley P. DesJardins (Simula, Inc., Tempe, Ariz.) *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 32 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19664# Hughes Helicopters, Culver City, Calif. Structural Analysis Section.
THE APPROACH TO CREW PROTECTION IN THE CRASH ENVIRONMENT FOR THE YAH-64
John M. McDermott *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19666# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
BAILOUT FROM AUTOROTATING HELICOPTERS
H. D. Melzig, U. Schmidt, and E. A. Bockemuller *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N79-18964# Transportation Systems Center, Cambridge, Mass.
VHF-FM EMERGENCY POSITION INDICATING RADIO BEACON Final Report, Jan. 1977 - Apr. 1978
P. D. Engels Oct. 1978 94 p refs
(AD-A061678; TSC-USCG-78-7; USCG-D-29-78) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report describes the development and testing of an Emergency Position Indicating Radio Beacon (EPIRB) which operates on Channels 15 and 16 of the Maritime Mobile VHF Band. It provides functions necessary to ensure that distress alerting and locating can be quickly and reliably provided for small craft in distress, in coastal maritime regions. When energized by a person in distress, the EPIRB will emit a radio signal which alternates between Channels 15 and 16 using international distress tones for modulation. Between transmissions, the EPIRB will turn off so as to conserve battery power. The EPIRB has been tested under actual distress conditions. It was demonstrated to provide a reliable distress alert to Coast Guard stations within a range of 20 nautical miles. Author (GRA)

N79-18965# Coast Guard Research and Development Center, Groton, Conn.
AN OVERVIEW OF ALTERNATIVE TECHNIQUES FOR DETERMINING POSITIONS AT SEA, WITH EMPHASIS ON APPLICABILITY OF POTENTIAL USE FOR POSITIONING BUOYS Final Report
Robert L. Couchman Mar. 1978 134 p refs
(AD-A061997; CGR/DC-5/78; USCG-D-20-78) Avail: NTIS HC A07/MF A01 CSCL 17/7

In support of a Coast Guard effort to improve the capability of field units to place buoys at their assigned locations, an assessment of the potential of alternative techniques for determining position was undertaken. The primary objective of the evaluation was to catalog, in general terms, various field survey techniques of position determination, whether presently in use or in development, with particular emphasis on the general capabilities, limitations, and application of the individual techniques for use in positioning buoys. The results of this evaluation indicate that no single method can be used to satisfy the varied buoy placement scenarios. Instead, a combination of methods (including those presently used) would be most appropriate. Furthermore, no single combined-methods system would fit all applications unless it consisted of an all-encompassing set of equipments and procedures, an impractical solution. Laser rangefinder, precision gyrocompass, radiodetermination, and satellite methods are considered to have applicability to buoy placement operations, either as stand-alone or for incorporation with a multi-sensor system. Inertial guidance and underwater acoustic methods are not considered to have practical application. Author (GRA)

N79-18966# Phoenix Corp., McLean, Va.
OPTIMIZED, POST-MISSION DETERMINATION OF THE DEFLECTION OF THE VERTICAL USING RGSS DATA Final Report
Oct. 1978 70 p refs
(Contract DAAK70-78-C-0069)
(AD-A061771; ETL-0164) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report is a continuation of an earlier report on a potentially optimal method of recovering deflections of the vertical from RGSS data. In this report, the implementation of the method and estimates of the errors associated with the method are described. In the first section, an optimal weighting technique is derived. This technique also leads directly to a priori error estimates. Next, the results from using the method on hypothetical traverses are described. From these data, it appears that the optimal method can lead to a significant reduction in the errors

in estimating the deflections of the vertical. A final appendix gives instructions for the use of the associated computer program. Author (GRA)

N79-18967# Champlain Technology, Inc., West Palm Beach, Fla.
AIR FORCE/NATIONAL AIRSPACE SYSTEM INTERFACE STUDY Final Technical Report, Sep. 1977 - Jan. 1978
E. H. Bolz Jun. 1978 91 p refs
(Contract F33615-77-C-3079)
(AD-A061709; AFFDL-TR-78-69) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report documents the results of a study to determine what actions the Air Force should be taking to remain compatible with the National Airspace System as it evolves in the future. The Federal Aviation Administration (FAA), through implementation of the Upgraded Third Generation Air Traffic Control System, will be requiring new avionics functions in aircraft which operate in the Air Traffic Control system. A large number of Air Force aircraft regularly operate in the Air Traffic Control system and so are affected by changes to its structure. The purpose of this study was to determine those FAA plans or programs which will impact avionics requirements, to analyze the major new avionics development plans of the Air Force, and to determine the interface problems which will then exist for Air Force aircraft operation in the National Airspace System. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-18968 Old Dominion Univ., Norfolk, Va.
DESIGN, CALIBRATION, AND APPLICATION OF A SENSOR FOR MEASURING TIME DEPENDENT ANGLE OF ATTACK OF HELICOPTER BLADES Ph.D. Thesis
Weiyuan Henry Liu 1978 206 p
Avail: Univ. Microfilms Order No. 7904820

Various pressure probes were designed and tested which could be attached to helicopter blades when a helicopter is i flight. The pressure probes consisted of spherical heads which were held in place by cylindrical shanks. Built inside the heads were transducers to measure the pressure differential between pressure ports which were located on the front portion of the spherical head facing the airstream. Data was obtained over a range of airstream velocity of 11.6 to 88.4 m/s(38 to 290 ft/sec), corresponding to Reynolds numbers of 24,000 184,000 based on the sphere diameter. Both static and dynamic tests were performed. For the dynamic testing cases, the probe oscillating frequency was varied from 1.59 to 5.20 Hz., covering the range of frequencies typical of helicopter blade motion. Dissert. Abstr.

N79-18969# Dynamics Research Corp., Wilmington, Mass. Systems Div.
AN ANALYSIS OF FUEL CONSERVING OPERATIONAL PROCEDURES AND DESIGN MODIFICATIONS FOR BOMBER/TRANSPORT AIRCRAFT. VOLUME 1: EXECUTIVE SUMMARY Final Report, 7 Jun. 1976 - 7 Jul. 1978
R. Aggarwal Jul. 1978 24 p refs
(Contract F33615-76-C-3104)
(AD-A061746; R-247U-Vol-1; AFFDL-TR-78-96-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 01/3

Various proposed improvements in the design and operational procedures for bomber/transport aircraft are evaluated. The evaluation is performed in terms of the estimated savings in fuel consumption and in Direct Operating Cost (DOC). As an aid in the evaluation of design modifications, graphs of fuel and DOC savings as a function of the design parameters are developed. These graphs are based on actual mission trajectory data rather than some type trajectory profile. The actual mission data is presented in terms of histograms which provide statistical information concerning altitude, air speed, take-off weight, landing weights, and mission time. Separate analyses are performed on the following aircraft: the B-52G, the B-52H, the KC-135, the C-141, the C-130, and the C-5A. Author (GRA)

N79-18970# Naval Test Pilot School, Patuxent River, Md.
PRINCIPLES OF HELICOPTER PERFORMANCE
Robert B. Richards 8 Mar. 1968 142 p refs
(AD-A061671; USNTPS-T-1) Avail: NTIS HC A07/MF A01 CSCL 01/13

This textbook is used as the primary reference for the Helicopter Performance Course at the U.S. Naval Test Pilot School. The Helicopter Performance Course is an integral part of the School curriculum, the particular requirements of which influence the manner and degree of development of these notes. The course is intended to provide a background for the helicopter performance flight projects conducted by the students. The helicopter, with emphasis on the main rotor, is analyzed in various flight conditions to determine the major factors which influence the performance. Simplified analysis is first applied to hover and then extended to include translational conditions after which consideration is given to the effect of some of the more significant simplifications. Author (GRA)

N79-18971# Calspan Corp., Buffalo, N. Y.
TOTAL ENVIRONMENT SURVIVABILITY METHODOLOGY Final Report, Oct. 1977 - Mar. 1978
Charles J. Krebs, Hans G. Reif, and William E. Ring Wright-Patterson AFB, Ohio AFFDL Jul. 1978 105 p refs
(Contract F33615-77-C-2102; AF Proj. 2402)
(AD-A061888; CALSPAN-6200-X-2; AFFDL-TR-78-90) Avail: NTIS HC A06/MF A01 CSCL 12/2

This report documents the results of an analytical study to develop an architecture for a Total Environment Survivability (TES) methodology to provide a capability to evaluate the relative importance of: (1) threats on technologies and (2) technologies on air flight vehicle non-nuclear survivability in the total environment. This methodology couples mission effectiveness and life cycle cost analysis techniques to yield a final measure of merit (MOM) or payoff for each technology evaluated. Three candidate methodologies are described which were studied and compared to arrive at the final selected approach. The selected methodology is described in detail along with a qualitative assessment of the methodology using a candidate technology and threat problem. The report also documents the development plan for the implementation of the methodology. Author (GRA)

N79-18972# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT Semiannual Summary Report, 1 Jan. 1962 - 30 Jun. 1978
Alan M. Kaniss 1 Nov. 1978 159 p
(AD-A061894; NADC-13920-2) Avail: NTIS HC A08/MF A01 CSCL 01/3

This report is a specialized summary of normal acceleration data recorded by counting accelerometers. Data are separated by calendar time and mission category. Only data reported in the counting accelerometer program are included. Author (GRA)

N79-18886# General Dynamics Corp., San Diego, Calif.
F-16 HIGH ANGLE OF ATTACK TESTING
Philip F. Oestricher and Robert C. Ettinger (AFFTC, Edwards AFB, Calif.) *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 1-10 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

N79-18888# McDonnell-Douglas Corp., St. Louis, Mo.
F-18 STATUS REPORT
John E. Krings *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 21-25 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

N79-18889# Israeli Air Force, Zahal.
FLIGHT TESTING THE KFIR
Yitzhak Peer *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 26-37 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

N79-18890# Rockwell International Corp., Canoga Park, Calif. Collins Avionics and Missiles Group.
COCKPIT MANAGEMENT
C. I. Rice *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 39-42 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

N79-18893# Cincinnati Univ., Ohio.
THE LEARJET LONGHORN SERIES: THE FIRST JETS WITH WINGLETS
Neil A. Armstrong and Peter T. Reynolds (Gates Learjet Corp.) *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 57-66 refs (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

N79-18894*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLYING NASA'S TERMINAL CONFIGURED VEHICLE AGAINST THE MICROWAVE LANDING SYSTEM
Lee H. Person, Jr. and Kenneth R. Yenni *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 110-123 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01 CSCL 01C

N79-18895# Lockheed Aircraft Corp., Burbank, Calif.
DEVELOPMENT OF THE L-1011 FLIGHT MANAGEMENT SYSTEM
Donald A. Moor *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 124-134 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

N79-18896# Boeing Co., Seattle, Wash.
THE CONTINUITY FACTOR IN AIRCRAFT DEVELOPMENT
A. M. Johnston *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 135-145 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

N79-18897# Rockwell International Corp., Canoga Park, Calif.
XF4D SKYRAY DEVELOPMENT: NOW IT CAN BE TOLD
Robert O. Rahn *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 147-161 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

N79-18898*# National Aeronautics and Space Administration, Washington, D. C.
WHEN FLIGHT TEST WAS THE ONLY WAY
A. Scott Crossfield (US House Sci. and Technol. Committee) and Walt Williams *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 162 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01 CSCL 01C

N79-19625# Sikorsky Aircraft, Stratford, Conn.
ADVANCEMENTS IN HELICOPTER COCKPIT TECHNOLOGY
Howard P. Harper *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19631# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
DESIGN PROCEDURE FOR AN INFORMATION TRANSFER METHOD CUBITS FOR ALLOCATING PANEL AREA FOR AIRCREW STATION CONTROLS AND DISPLAYS
Patrick M. Curran *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 10 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19641# Army Aeromedical Research Lab., Fort Rucker, Ala.
VISUAL POCKETS: A DESIGN PARAMETER FOR HELICOPTER INSTRUMENT PANELS
R. W. Bailey and David D. Glick *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 4 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19643# Human Engineering Labs., Aberdeen Proving Ground, Md.
INTERNAL COCKPIT REFLECTIONS OF EXTERNAL POINT LIGHT SOURCES FOR THE MODEL YAH-64 ADVANCED ATTACK HELICOPTER
Christopher C. Smyth *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 16 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19657# Army Agency for Aviation Safety, Fort Rucker, Ala.
ASSESSMENT OF THE BENEFITS OF AIRCRAFT CRASHWORTHINESS
Andrew E. Gilewicz *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 8 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19659# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
SOME IMPROVEMENTS TO THE UK HELICOPTER COCKPIT
D. C. Reader *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 3 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19660# Army Aeromedical Research Lab., Fort Rucker, Ala.
HELICOPTER CRASHWORTHY FUEL SYSTEMS AND THEIR EFFECTIVENESS IN PREVENTING THERMAL INJURY
Stanley C. Knapp, Pierre Allemond (Army Agency for Aviation Safety, Ft. Rucker, Ala.), and David H. Karney *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19661# Arizona State Univ., Tempe. Engineering Safety Center.
A METHOD FOR SELECTING A CRASHWORTHY FUEL SYSTEM DESIGN
S. Harry Robertson and James W. Thurbow *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19663# Sikorsky Aircraft, Stratford, Conn. Systems Engineering Branch.
CRASH SURVIVABILITY OF THE UH-60A HELICOPTER
Brian L. Carnell *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 10 p (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-18973*# University of Southern Illinois, Carbondale. Dept. of Electrical Sciences and Systems Engineering.
GASP-PL/I SIMULATION OF INTEGRATED AVIONIC SYSTEM PROCESSOR ARCHITECTURES M.S. Thesis
Glen A. Brent Sep. 1978 274 p refs
(Grant NsG-2238)
(NASA-CR-158244) Avail: NTIS HC A12/MF A01 CSCL 01D

A development study sponsored by NASA was completed in July 1977 which proposed a complete integration of all aircraft instrumentation into a single modular system. Instead of using the current single-function aircraft instruments, computers

compiled and displayed inflight information for the pilot. A processor architecture called the Team Architecture was proposed. This is a hardware/software approach to high-reliability computer systems. A follow-up study of the proposed Team Architecture is reported. GASP-PL/1 simulation models are used to evaluate the operating characteristics of the Team Architecture. The problem, model development, simulation programs and results at length are presented. Also included are program input formats, outputs and listings. G.Y.

N79-18974# Naval Research Lab., Washington, D. C.
SOFTWARE REQUIREMENTS FOR THE A-7E AIRCRAFT
Kathryn L. Heninger, John W. Kallander, David L. Parnas, and John E. Shore 27 Nov. 1978 523 p refs
(AD-A061751; NRL-MR-3876) Avail: NTIS HC A22/MF A01 CSCL 01/3

The Naval Research Laboratory and the Naval Weapons Center are engaged in a joint project to redesign and rebuild the A-7E Operational Flight Program (OFP) using several advanced software engineering principles. This report is the first product of the project. It describes the required behavior of the OFP without describing an implementation. It also describes relevant characteristics of the A-7 computer, sensors, and display devices. Primarily intended as a reference document for the rest of the project, this report also serves as a complete example of good requirements definition. Its organization allows rapid answering of specific questions. A large amount of information is presented concisely and precisely in formats that facilitate checking for completeness and consistency. The documentation techniques illustrated by this report should be useful for other software development projects. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-18975 Tennessee Univ., Knoxville.
INVESTIGATION OF THE AERODYNAMIC AND ACOUSTIC PERFORMANCE OF A LOW-PRESSURE RATIO TANDEM-BLADE COMPRESSOR Ph.D. Thesis
Jenn-Gang John Cherng 1978 224 p
Avail: Univ. Microfilms Order No. 7903408

The experimental results show that the tandem blade configuration is capable of reducing the rotor-stator interaction noise by reducing the radial wake distortion behind the rotor blades, especially at highly loaded conditions, i. e., higher rotor speeds. Span wise circulation distribution can have a significant influence on noise generation for the single rotor and for the rotor-stator combinations. The design parameters of an axial flow compressor such as the blade twist angle, rotor solidity, rotor degree of reaction, and hydraulic efficiency etc., were investigated. A series of computations on the effects of geometric changes on the flow characteristics of tandem-blade compressor rotors are presented. Dissert. Abstr.

N79-18976*# Shaker Research Corp., Ballston Lake, N. Y.
TURBOJET BLADE VIBRATION DATA ACQUISITION DESIGN AND FEASIBILITY TESTING Final Report
J. L. Frarey, N. J. Petersen (Amherst Systems), and D. A. Hess Nov. 1978 72 p
(Contract NAS3-21015)
(NASA-CR-159505; SRC-78-TR-36) Avail: NTIS HC A04/MF A01 CSCL 21E

A turbojet blade vibration data acquisition system was designed to allow the measurement of blade vibration. The data acquisition system utilizing 96 microprocessors to gather data from optical probes, store, sort and transmit to the central computer is described. Areas of high technical risk were identified and a two-microprocessor system was breadboarded and tested to investigate these areas. Results show that the system was feasible and that low technical risk would be involved in proceeding with the complete system fabrication. S.E.S.

N79-18977*# Naval Air Propulsion Test Center, Trenton, N.J.
ROTOR FRAGMENT PROTECTION PROGRAM: STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN US COMMERCIAL AVIATION DURING 1976 Final Report, 1975 - 1976
R. A. DeLucia and J. T. Salvino Jul. 1978 30 p
(NASA Order C-41581-B)
(NASA-CR-159474; NAPC-PE-9) Avail: NTIS HC A03/MF A01 CSCL 21E

Statistical information relating to the number of gas turbine engine rotor failures which occurred during 1976 in commercial aviation service use is presented. The predominant failure involved blade fragments, 88 percent of which were contained. Although fewer rotor rim, disk, and seal failures occurred, all were uncontained. Sixty-seven percent of the 186 rotor failures occurred during the takeoff and climb stages of flight. S.E.S.

N79-18978*# General Electric Co., Philadelphia, Pa.
CONTAINMENT OF COMPOSITE FAN BLADES Quarterly Progress Report, 1 Apr. - 30 Jun. 1977
A. P. Coppa and C. L. Stotler 1977 15 p
(Contract NAS3-20118)
(NASA-CR-158168; QPR-4; R77AEG450) Avail: NTIS HC A02/MF A01 CSCL 21E

The development of containment concepts for use with large composite fan blades, taking into account the frangible nature of composite blades is considered. Aspects of the development program include; (1) an analysis to predict the interaction between a failed fan blade and the blade containment structure; (2) scaling factors to allow impact testing using subscale containment rings and simulated blades; (3) the design and fabrication of containment systems for further evaluation in a rotating rig test facility; (4) evaluate the test data against the analytically predicted results; and (5) determine overall systems weights and design characteristics of a composite fan stage installation and compare to the requirements of an equivalent titanium fan blade system. Progress in the blade impact penetration tests and the design and fabrication of blade containment systems is reported. J.M.S.

N79-18979# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBINE BLADE COOLING
1976 539 p refs Partly in ENGLISH and FRENCH Lecture held at Rhode Saint Genese, Belgium, 12-16 Jan. 1976
(VKI-Lecture-Series-83) Avail: NTIS HC A23/MF A01

An introductory lecture presented the contemporary trends in gas turbine development and their impact on turbine design. A survey of the techniques and information available on heat transfer coefficients and cooling efficiency was made, with emphasis on impingement and film types of cooling. The test corrosion phenomena was reviewed. The possibility of cooling by fluids other than air was discussed. The methods for calculation of stresses, deformation, fatigue and life expectancy of cooled blades was described. The interaction between cooling requirements and aerodynamic design was considered. For individual titles, see N79-18980 through N79-18988.

N79-18980# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Melun (France).
TURBINE BLADE COOLING
Jerome Francois *In* Von Karman Inst. for Fluid Dyn. Turbine Blade Cooling 1976 22 p refs (For primary document see N79-18979 10-07)
Avail: NTIS HC A23/MF A01

Increasing the compression ratio and maximum temperature of thermodynamic cycles influences the design of gas turbines. The various cooling techniques used not only multiply the number of parameters to be considered in blade design, but also complicate the technology, and interfere with aerodynamics. Problems involved in the design of a blade capable of withstanding high temperatures relate not only to thermodynamics, but also to aerodynamics, heat, resistance, technology, and fabrication methods. The finally constructed blade will represent a compromise

of the respective requirements of each of these disciplines.
Transl. by A.R.H.

N79-18981# Ateliers de Constructions Electriques de Charleroi (Belgium). Lab. de Recherches.
IMPINGEMENT COOLING: A REVIEW
Y. Becko *In* Von Karman Inst. for Fluid Dyn. Turbine Blade Cooling 1976 40 p refs (For primary document see N79-18979 10-07)
Avail: NTIS HC A23/MF A01

A review of both local and mean Nusselt number correlations available for impingement cooling techniques is given for round and slot jets in single, lines or arrays configurations. Emphasis is put on applications in the gas turbine field and a cooling efficiency comparison of these various techniques is developed.
G.Y.

N79-18982# Oxford Univ. (England). Dept. of Engineering Science.
A SURVEY OF FILM COOLING THEORY AND EXPERIMENT
D. L. Schultz *In* Von Karman Inst. for Fluid Dyn. Turbine Blade Cooling 1976 124 p refs (For primary document see N79-18979 10-07)
Avail: NTIS HC A23/MF A01

Although there is a substantial body of information available on heat transfer rates to film cooled surfaces, much of it is difficult to apply with confidence to the gas turbine environment. The most basic measurements were carried out with modest gas-to-wall temperature ratios although their value is enhanced by the large scale of the injection system and resulting fine detail in the observations. The purpose of this paper is to report more recent data obtained in facilities which more closely approximate to the turbine blade in its severe thermal and aerodynamic external flow.
G.Y.

N79-18983# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Dept. of Aeronautics and Aerospace.
HEAT TRANSFER TO COOLED TURBINE BLADES: A REVIEW
B. E. Richards *In its* Turbine Blade Cooling 1976 40 p refs (For primary document see N79-18979 10-07)
Avail: NTIS HC A23/MF A01

A literature survey is provided of the prediction and measurement of heat transfer to external surfaces of turbine bladings in an environment as closed as possible to that obtained in a real turbine. The procedure that a cooling system designer may follow is presented. The relevant equations and categorisation of solutions for the compressible boundary layer equations are presented. A qualitative description of the behavior of the boundary layer over a blade is given. A state of the art literature survey is presented with recommendations for future research.
G.Y.

N79-18984# Creare, Inc., Hanover, N.H. Fluids/Thermal Engineering Div.
ALTERNATIVE TURBINE COOLING TECHNOLOGY
David Japikse *In* Von Karman Inst. for Fluid Dyn. Turbine Blade Cooling 1976 39 p refs (For primary document see N79-18979 10-07)
Avail: NTIS HC A23/MF A01

Alternatives to conventional gas turbine airfoil cooling (compressor discharge air) have existed for more than three decades. Air cooling gained early popularity due to convenience; now restructured energy values offer incentive to consider alternatives. A variety of demonstrated airfoil cooling alternatives are reviewed and a careful assessment of the current technology base for designing alternative cooling methods is presented here. A speculative view of future alternative applications is offered.
G.Y.

N79-18985# Creare, Inc., Hanover, N.H. Fluids/Thermal Engineering Div.
LIFE EVALUATION OF ADVANCED TURBOMACHINERY
David Japikse *In* Von Karman Inst. for Fluid Dyn. Turbine Blade Cooling 1976 63 p refs (For primary document see N79-18979 10-07)
Avail: NTIS HC A23/MF A01

Important recent and time proven life calculation methods for high performance turbomachinery components are reviewed on the basis of design worthy technique. Creep, fatigue and fatigue interaction are examined. The design role for crack propagation methods is examined. A number of design examples are given and critiqued. An approach to mission analysis is considered.
Author

N79-18986# Rolls-Royce Ltd., Derby (England). Derby Engine Div.
THE AERODYNAMIC PENALTIES ASSOCIATED WITH TURBINE BLADE COOLING
B. Barry *In* Von Karman Inst. for Fluid Dyn. Turbine Blade Cooling 1976 36 p refs (For primary document see N79-18979 10-07)
Avail: NTIS HC A23/MF A01

A state of the art review of the cooled aero engine turbine design field is provided, in particular the interactions between the aerodynamic and cooling requirements/constraints of the turbine. The processes which a designer goes through to establish the preliminary characteristics of the turbine are considered. The aerodynamic and cooling interactions and losses are also considered.
G.Y.

N79-18987# Liege Univ. (Belgium). Aerospace Engineering Lab.
THERMAL FIELDS AND STRESSES IN COOLED TURBINE BLADES BY THE FINITE ELEMENT METHOD
Michel A. Hogge *In* Von Karman Inst. for Fluid Dyn. Turbine Blade Cooling 1976 25 p refs (For primary document see N79-18979 10-07)
Avail: NTIS HC A23/MF A01

The Finite Element Method is rapidly becoming a wide-spread procedure for the evaluation of heat transfer and associated thermal stresses in complex structures. This paper presents the main approaches to the problem using so-called temperature and displacement models. All kind of heat transfer are considered, including the nonlinear case, while the thermal stresses analysis is achieved in the frame of uncoupled thermoelasticity. Various situations concerning turbine blades and rotors are analyzed to illustrate the theory.
G.Y.

N79-18988# Centre National de Recherches Metallurgiques, Liege (Belgium).
HOT CORROSION PHENOMENA IN GAS TURBINES
A. Davin *In* Von Karman Inst. for Fluid Dyn. Turbine Blade Cooling 1976 17 p refs (For primary document see N79-18979 10-07)
Avail: NTIS HC A23/MF A01

The environment encountered in gas turbines include combustion products and substances conveyed with the fuel and air in addition to media such as water or salt in marine engine practice. Whereas massive damage and instantaneous engine failure may be caused by ingestion of large objects the impurities present in the fuel and in air may cause corrosion. Hot corrosion is interpreted as the accelerated attack of components of the combustion system and turbine stator and rotor blades in the simultaneous presence of oxygen, sulphur compounds and salts of alkali metals. The following topics are discussed: (1) general law of oxidation; (2) hot corrosion in combustion gases; (3) influence of the alloy composition on its hot corrosion resistance; and (4) protection by coating.
G.Y.

N79-18989# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TRANSONIC FLOWS IN AXIAL TURBOMACHINERY, VOLUME 1
1976 284 p refs Lecture held at Rhode Saint Genese, Belgium, 2-6 Feb 1976 2 Vol.
(VKI-Lecture-Series-84-Vol-1) Avail: NTIS HC A13/MF A01

Time marching finite area method, turbine and compressor cascade test, extension of the finite area time marching method to three dimensions, and transonic relaxation are discussed. For individual titles, see N79-18990 through N79-18993.

N79-18990# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Dept. of Turbomachinery.
TIME MARCHING FINITE AREA METHOD
Michel Couston *In its* Transonic Flows in Axial Turbomachinery,

Vol. 1 1976 42 p refs (For primary document see N79-18989 10-07)
Avail: NTIS HC A13/MF A01

Aerodynamically efficient blades linked to the knowledge of shock strength and position because a slight blade profile variation ca induce strong shock waves and boundary layer separation are discussed. A numerical method to solve the steady transonic blade to blade flow in axial turbomachinery is developed. A two dimensional problem using the isentropic assumption was examined. The damping surface, rotor tip and stator hub sections, blade velocity distribution, Mach number, and wall profiles were investigated. S.E.S.

N79-18991# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

TURBINE AND COMPRESSOR CASCADE TEST CASES. 1: TURBINE CASCADES. 2: COMPRESSOR CASCADES

Michel Couston, A. Morris (Natl. Gas Turbine Estab., Farnborough, Engl.), G. Meauze (ONERA, Chatillon-sous-Bagneux, France), H. Starken (DVLR, Cologne, W. Ger.), and Rene VandenBraembussche *In its* Transonic Flows in Axial Turbomachinery, Vol. 1 1976 40 p refs (For primary document see N79-18989 10-07)
Avail: NTIS HC A13/MF A01

Two turbine cascades with gas turbine nozzles are presented. Blade and wall profiles are given in velocity and pressure distributions. Isentropic Mach number for different pseudo streamlines and back pressure for the profiled wall is discussed. Multiple and double circular arc blades and their geometry are defined. S.E.S.

N79-18992# Central Electricity Generating Board, Southampton (England).

EXTENSION OF THE FINITE AREA TIME MARCHING METHOD TO THREE DIMENSIONS

J. D. Denton *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Axial Turbomachinery, Vol. 1 1976 45 p refs (For primary document see N79-18989 10-07)
Avail: NTIS HC A13/MF A01

A numerical scheme for the finite area method of flow calculation is presented. The high stability and accuracy with greatly reduced computer time are combined. Two dimensional and quasi three dimensional flow solution are obtained in computer times comparable to the fastest existing methods but with the advantage that no distinction needs to be made between subsonic and supersonic flow. The speed of the method is extended to three dimensional flow for which shock free solutions of acceptable accuracy can be obtained in a few minutes computer time. Three dimensional and quasi three dimenstional solutions are compared the assumptions inherent in the latter can lead to significant errors were proved. S.E.S.

N79-18993# AiResearch Mfg. Co., Phoenix, Ariz.

TRANSONIC RELAXATION

P. R. Doge *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Axial Turbomachinery, Vol. 1 1976 102 p refs (For primary document see N79-18989 10-07)
Avail: NTIS HC A13/MF A01

The relaxation method to fluid mechanics for solutions of inviscid flows in turbomachinery is developed. An extension of the mathematical consequences of fluid dynamic dilemma are discussed. Fundamentals necessary to interest full scale numerical results are described. The relaxation method and the successes used to calculate full scale turbomachinery flows are presented. S.E.S.

N79-18994# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

TRANSONIC FLOWS IN AXIAL TURBOMACHINERY, VOLUME 2

1976 416 p refs Proc. of Lectures held 2-6 Feb. 1976 (VKI-Lecture-Series-84-Vol-2) Avail: NTIS HC A18/MF A01

Shock wave boundary layer interactions and boundary layer calculations are evaluated. Subsonic and supersonic outlet flows are discussed. Flows in cascades and rotors are compared based on laser measurements. Industrial design and analysis methods are presented. For individual titles, see N79-18995 through N79-19003.

N79-18995# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

BOUNDARY LAYER CALCULATIONS FOR COMPRESSIBLE FLOW

R. VanDenBraembussche *In its* Transonic Flow in Axial Turbomachinery, Vol. 2 1976 32 p refs (For primary document see N79-18994 10-07)
Avail: NTIS HC A18/MF A01

Turbulent and compressible boundary layer calculation methods are reviewed. The correct accounting for compressibility effects and the ability of the method to be applied to boundary layers under non-equilibrium conditions are discussed. Examples of the integral method using partial differential equations are presented. S.E.S.

N79-18996# Poitiers Univ. (France).

RECENT PROGRESS IN SHOCK WAVE-BOUNDARY LAYER INTERACTION

Roger Leblanc *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Axial Turbomachinery, Vol. 2 1976 136 p refs (For primary document see N79-18994 10-07)
Avail: NTIS HC A18/MF A01

The characteristics of the interaction region and resulting effects on the potential flow were studied. Supersonic and hypersonic laminar or turbulent boundary layers interacting with oblique shock waves were investigated. The effects of pressure gradient outside the boundary layer are presented. The effects of three dimensionality and unsteadiness in transonic interaction are discussed. Numerical methods are used in the solution of oblique shock wave laminar and turbulent boundary layer interaction. S.E.S.

N79-18997# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

OUTLET AIR ANGLE PREDICTION FOR SUBSONIC FLOW CASCADES

R. VanDenBraembussche *In its* Transonic Flows in Axial Turbomachinery, Vol. 2 1976 34 p refs (For primary document see N79-18994 10-07)
Avail: NTIS HC A18/MF A01

In order to define the unique outlet air angle corresponding to real flow, three groups of criteria were developed: (1) relates the outlet air angle to overall geometrical data; (2) relates the outlet air angle to local flow condition at the trailing edge and contains the Kutta condition; and (3) directly relates the outlet air angle to the viscous inviscid interation of the flow. S.E.S.

N79-18998# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

THE BASE PRESSURE PROBLEM IN TRANSONIC TURBINE CASCADES. PART 1: CASCADE TESTS. PART 2: MODEL TESTS

C. Sieverding *In its* Transonic Flows in Axial Turbomachinery, Vol. 2 1976 61 p refs (For primary document see N79-18994 10-07)
Avail: NTIS HC A18/MF A01

Base pressure measurements in actual cascade configurations for outlet flow conditions from high subsonic to supersonic Mach number are presented. Due to the small size of the blades, the trailing edge pressure is measured in one point only. A attempt to relate the base pressure to important cascade and flow parameters is made. S.E.S.

N79-18999# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

MODEL TESTS FOR THE DETAILED INVESTIGATION OF THE TRAILING EDGE FLOW IN CONVERGENT TRANSONIC TUBINE CASCADES

C. Sieverding, M. Decuyper, O. Amana, and J. Colpin *In its* Transonic Flows in Axial Turbomachinery, Vol. 2 1976 28 p refs (For primary document see N79-18994 10-07)
(Contract N00014-69-A-0204-0079)
Avail: NTIS HC A18/MF A01

Some experiments concerning the trailing edge flow of transonic turbine bladings are presented. The experiments are conducted on a model simulating very closely the flow in the overhang section of convergent turbine cascades. Cascade flow conditions with shock free flow in the overhang section (limit

load conditions) and cascade flow conditions characterized by trailing edge shock interferences with the flow in the overhang section were tested. The trailing edge separation shock and the length of the isobaric trailing edge base region were examined. The results indicate that the strength of the separation shock for the rounded trailing edge is of the same order as the strength of the lip shock for sharp edged wedges. The length of the isobaric base region is only 60% to 80% of the trailing edge thickness while the pressure recovery region is about twice as long as the constant pressure region. S.E.S.

N79-19000# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
COMPARISON BETWEEN FLOWS IN CASCADES AND ROTORS IN THE TRANSONIC RANGE. 1: BASIC CONSIDERATIONS
H. Starken *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Axial Turbomachinery, Vol. 2 1976 18 p refs (For primary document see N79-18994 10-07)
Avail: NTIS HC A18/MF A01

Five different parameters which influence a comparison between stationary cascade tests results and axial flow turbomachine measurements are discussed. The parameters are: (1) cascade projection; (2) axial velocity; (3) position of reference planes; (4) data reduction method; and (5) viscosity effects. S.E.S.

N79-19001# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
COMPARISON BETWEEN FLOWS IN CASCADES AND ROTORS IN THE TRANSONIC RANGE. 2: INVESTIGATION OF TWO TRANSONIC COMPRESSOR CASCADES AND COMPARISON WITH ROTOR DATA
H. A. Schreiber *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Axial Turbomachinery, Vol. 2 1976 32 p refs (For primary document see N79-18994 10-07)
Avail: NTIS HC A18/MF A01

The influence of the axial velocity density ratio on the transonic cascade flow by varying the sidewall contraction was studied. The flow behavior, the static pressure, transonic and supersonic range on the shock wave configuration, the shock losses, and the throat area inside of the blade are described. S.E.S.

N79-19002# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
COMPARISON BETWEEN FLOWS IN CASCADES AND ROTORS IN THE TRANSONIC RANGE. 3: COMPARISON OF EXPERIMENTAL AND THEORETICAL RESULTS OF FLOW STUDIES ON BLADE-TO-BLADE SURFACES IN AN AXIAL COMPRESSOR ROTOR
R. Dunker, P. Strinning, and H. G. Hungenberg *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Axial Turbomachinery, Vol. 2 1976 19 p refs (For primary document see N79-18994 10-07)
Avail: NTIS HC A18/MF A01

A nonintrusive flow-velocity measuring method on an optical basis is described. This technique is developed for applications in turbomachines, where extremely difficult test conditions are normally present. Results of experimental investigations and of quasi-three-dimensional calculations in axial compressor rotors are compared. The results demonstrate the capability of this technique for future research work on turbomachines and especially for the development of the aerodynamic calculation methods. S.E.S.

N79-19003# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
PROSPECTS FOR INDUSTRIAL DESIGN AND ANALYSIS SYSTEMS
R. VanDenBraembussche *In its* Transonic Flows in Axial Turbomachinery, Vol. 2 1976 15 p refs (For primary document see N79-18994 10-07)
Avail: NTIS HC A18/MF A01

The analysis and design methods for axial turbomachines are presented. The three dimensional and real flows were investigated. The potential flow method, and the boundary layer calculation method, and the coupling of these methods are discussed. S.E.S.

N79-19004# Naval Research Lab., Washington, D. C. Ocean Technology Div.
FAILURE STUDIES OF A THIRD STAGE FAN DISK FROM A TF-30 TURBINE ENGINE Final Report
W. H. Vaughan, R. J. Sanford, J. M. Krafft, W. H. Cullen, and J. W. Dally (Maryland Univ., College Park) 13 Nov. 1978 29 p refs
(AD-A061801; NRL-MR-3874) Avail: NTIS HC A03/MF A01 CSCL 21/5

A detailed failure analysis was made of a fan disk from the third stage of the Navy's turbo-jet engine in order to gain a better understanding of the origin and growth kinetics of the cracks that had developed in service. The in service stress that had caused the cracks to originate was determined by a two dimensional photoelastic and holographic stress analysis. A further experimental stress analysis was made to determine the stress intensity factor, after the crack had formed, as a function of crack length. These results were compared with a fractographic study of the bearing surface and the fracture surface. It was found that the striation spacings were in good agreement with the calculated values of the stress intensity factor. Some conclusions were drawn concerning the origin and growth mechanism of these cracks. Author (GRA)

N79-19005# ARO, Inc., Arnold Air Force Station, Tenn.
COMPARISONS OF TURBINE ENGINE COMBUSTOR EXHAUST EMISSIONS MEASUREMENTS USING THREE GAS-SAMPLING PROBE DESIGNS Final Report, 1 Dec. 1976 - 30 Aug. 1977
R. J. Bryson and J. D. Few Nov. 1978 67 p refs
(AD-A061733; AEDC-TR-78-7) Avail: NTIS HC A04/MF A01 CSCL 21/5

The effects of sampling probe design and probe operating procedures on measurements of concentrations of nitric oxide (NO), oxides of nitrogen (NOx), carbon monoxide (CO), carbon dioxide (CO2), total hydrocarbons (CxHy), and gaseous hydrogen (H2) in the exhaust of a turbine engine combustor were studied. Measurements of the concentrations were made using commercial gas analysis instruments and three types of gas-sampling probes. The probe types were a tubular inlet probe, a quick-quench probe, and a dilution probe. Diluent gas (N2, A, He) and diluent flowrate effects on measurements were studied for the dilution probe. Effects of sampling surface material and sample residence time in the probe were investigated for the tubular inlet probe, and the effects of pressure ratio across the quick-quench probe were determined. At fuel-to-air ratios greater than 0.01, the levels of NO, NOx and CO2 were somewhat smaller for the quick-quench and dilution probes than for the tubular inlet probe. The measured concentrations of carbon monoxide and unburned hydrocarbons, however, were greater for the quick-quench and dilution probes than for the tubular inlet probe. Author (GRA)

N79-18891# Garrett Corp., Torrance, Calif.
SMALL FAN-JET ENGINES
Ivan E. Speer *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 43-51 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-19006 Ohio State Univ., Columbus.
AEROSERVOELASTIC STABILITY ANALYSIS OF AN AIRPLANE WITH A CONTROL AUGMENTATION SYSTEM Ph.D. Thesis
Robert Lee Moore 1978 200 p
Avail: Univ. Microfilms Order No. 7902191

The aeroservoelastic stability equations of motion, including

the airframe dynamics, the unsteady aerodynamics, and the control augmentation system, were developed by using a modal representation in the Laplace domain. For this formulation, the unsteady aerodynamics were transformed from the commonly used frequency domain into the Laplace domain. Fitted Laplace polynomial fractions for the Laplace transformed generalized aerodynamic forces were derived. These fitted Laplace polynomial fractions were formulated for a given flight condition (i.e., a particular Mach number and altitude), were applicable for all frequencies within the desired frequency fit range, and were most valid for Laplace arguments near the imaginary axis (small positive or negative damping) along which the fit was made and which was the region of the greatest physical interest for stability. Dissert. Abstr.

N79-19007# General Electric Co., Binghamton, N.Y. Aerospace Controls and Electrical Systems Dept.
DIRECT DRIVE CONTROL VALVE FOR FLY-BY-WIRE FLIGHT CONTROL SYSTEM ACTUATORS Final Report, Apr. 1976 - Dec. 1977
D. Hogan and J. E. Rinde Mar. 1978 144 p refs
(Contract F33615-76-C-3037)
(AD-A062030; ACS-11595; AFFDL-TR-78-32) Avail: NTIS HC A07/MF A01 CSCL 01/3

The development of a high force linear motor suitable for directly actuating an aircraft hydraulic power control valve used on a flight control system actuator is described. A breadboard unit was fabricated and tested and met the 80 lb. midpoint force requirement with an input of 4.4 amperes (1.1 amps/coil). A modified F-4 aileron actuator incorporating the force motor and position LVDT's met the frequency response requirements. Three sets of brassboard equipment each consisting of a modified F-4 aileron actuator incorporating a new force motor and position LVDT's and an electronic control box were designed, fabricated and tested. One set was subjected to and satisfactorily completed flightworthiness tests. The remaining are available for flight testing. Author (GRA)

N79-19008# Northrop Corp., Hawthorne, Calif. Aircraft Div.
VALIDATION OF MIL-F-9490D: GENERAL SPECIFICATION FOR FLIGHT CONTROL SYSTEM FOR PILOTED MILITARY AIRCRAFT. VOLUME 1: SUMMARY OF YF-17 AND C-5A VALIDATIONS Final Report, Apr. 1976 - Jan. 1977
S. Dobos-Bubno, Larry B. Hartsook, Ralph J. Hylton, and Harold A. Valery Apr. 1977 56 p refs
(Contract F33615-76-C-3034)
(AD-A061807; NOR-77-06-Vol-1; AFFDL-TR-77-7-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 01/3

This volume presents a summary of two studies performed to validate the new MIL-F-9490D Specification. This work was accomplished by the Northrop Corporation, Aircraft Division using the YF-17 Lightweight Fighter, and the Lockheed-Georgia Company using the C-5A Heavy Logistics Transport. This validation was based on existing ground test, flight test and analytical data as was available for this validation process. Each applicable paragraph was examined with regard to practicability, accuracy, and completeness as a requirement for procurement, design, test and installation of flight control systems for future piloted military aircraft. Recommendations have been made with regard to changes considered necessary to improve the practicability, accuracy, and completeness of the specification and to improve or update the Users Guide. Author (GRA)

N79-19009# Northrop Corp., Hawthorne, Calif. Aircraft Div.
VALIDATION OF MIL-F-9490D: GENERAL SPECIFICATION FOR FLIGHT CONTROL SYSTEM FOR PILOTED MILITARY AIRCRAFT. VOLUME 2: YF-17 LIGHTWEIGHT FIGHTER VALIDATION Final Report, Apr. 1976 - Jan. 1977
S. Dobos-Bubno and Larry B. Hartsook Apr. 1977 364 p refs
(Contract F33615-76-C-3034)
(AD-A062008; NOR-77-06-Vol-2; AFFDL-TR-77-7-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 01/3

This study was conducted to validate military specification MIL-F-9490D, 'Flight Control Systems-Design, Installation and Test of Piloted Aircraft, General Specification For,' dated 6 June 1975 by checking the specification requirements utilizing the experience and knowledge derived during the recent procurement of the YF-17 Lightweight Fighter. This validation was based on existing ground test, flight test and analytical data as was available for this validation process. Each applicable paragraph was examined with regard to practicability, accuracy, and completeness as a requirement for procurement, design, test and installation of flight control systems for future piloted military aircraft. Recommendations were made with regard to changes considered necessary to improve the practicability, accuracy, and completeness of the specification and to improve or update the Users Guide. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N79-19010*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
COMPUTER-AIDED COLLECTION OF DEMOGRAPHIC DATA WITHIN DAY-NIGHT LEVEL CONTOURS: TWO TEST CASES Final Report
Harry Seidman and Connice Bravelly Aug. 1978 30 p refs
(Contract F33615-76-C-0528)
(AD-A061657; BBN-3702; AMRL-TR-78-39) Avail: NTIS HC A03/MF A01 CSCL 20/1

This study demonstrates the feasibility of automating a procedure for counting the number of people exposed to various levels of aircraft noise near airbases. The procedure involves: developing contours of equal noise exposure about military installations based on aircraft noise and performance data and airport operational/flight track information using the NOISEMAP computer program; developing polygon descriptions of the noise contours that are compatible with commercially available demographic programs using census tract data; and outputing for land use planning purposes, demographic and socio-economic data for present or future years as a function of predicted noise exposure level. GRA

N79-19665# Naval Training Equipment Center, Orlando, Fla.
HELICOPTER UNDERWATER ESCAPE TRAINER (9D5)
William F. Cunningham *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 3 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N79-19011* National Aeronautics and Space Administration, Washington, D. C.
PLANETARY EXPLORATION BY NASA SPACECRAFT
27 Mar. 1979 5 p
(NASA-News-Release-79-35; P79-10032) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The planet, spacecraft, launch and encounter dates, and scientific findings are summarized. S.E.S.

N79-19012*# Martin Marietta Corp., Denver, Colo.
APPLICATION OF ADVANCED TECHNOLOGY TO SPACE AUTOMATION Final Report
Roger T. Schappell, John T. Polhemus, James W. Lowrie, Catherine A. Hughes, James R. Stephens, and Chieng-Y Chang Jan. 1979 325 p refs
(Contract NASw-3106)
(NASA-CR-158350; MCR-79-519) Avail: NTIS HC A14/MF A01 CSCL 22A

Automated operations in space provide the key to optimized mission design and data acquisition at minimum cost for the future. The results of this study strongly accentuate this statement and should provide further incentive for immediate development of specific automtion technology as defined herein. Essential automation technology requirements were identified for future programs. The study was undertaken to address the future role of automation in the space program, the potential benefits to be derived, and the technology efforts that should be directed toward obtaining these benefits. G.Y.

N79-19013*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NINTH CONFERENCE ON SPACE SIMULATION
1977 470 p refs Conf. held at Los Angeles, 26-28 Apr. 1977; sponsored in part by Inst. of Environ. Sci., AIAA, and Am. Soc. for Testing and Mater.
(NASA-CP-2007) Avail: NTIS HC A20/MF A01 CSCL 22A

The papers presented in this conference provided an international dialogue and a meaningful exchange in the simulation of space environments as well as the evolution of these technological advances into other fields. The papers represent a significant contribution to the understanding of space simulation problems and the utilization of this knowledge. The topics of the papers include; spacecraft testing; facilities and test equipment; system and subsystem test; life sciences, medicine and space; physical environmental factors; chemical environmental factors; contamination; space physics; and thermal protection. For individual titles, see N79-19014 through N79-19044.

N79-19014*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
PRECISION TEMPERATURE GRADIENT MEASUREMENTS ON WINDOW GLASS **c34**
George Mikk and Ward Petrie *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 5-14 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 20D

Surface temperature gradients were measured with miniature thermocouples installed in a 58.5 cm (23-inch) square window. Test measurements at 25 locations were made under vacuum and with the window operating in radiant heat transfer mode. The analysis of thermocouple design and installation is presented along with a lead wire routing scheme to allow for both differential and absolute temperature measurements while using a minimum number of signal feedthru paths through the test chamber wall. Typical test data and operational precautions are presented along with the accuracy analysis for installation effects and measurement effects to support differential temperature measurement precision values of + or - 0.06 C RMS + or - 0.1 F RMS). Author

N79-19015*# Hughes Aircraft Co., El Segundo, Calif.
DEVELOPMENT OF A FERROMAGNETIC ROTARY VACUUM SEALED SPACECRAFT SPIN FIXTURE **c14**
M. B. Levine *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 15-23 Sponsored in part by Intern. Telecommun. Satellite Organ. (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

A number of successful spacecraft tests were conducted on an environmental spin fixture which utilizes a ferrofluidic rotary vacuum seal. The 27 cm (10.5 inch) diameter fixture drive shaft supports and spins communications satellites during flight acceptance testing in a thermal vacuum chamber. The drive shaft rotary seal serves to maintain the canned drive system electro-mechanical components at ambient pressure within the space simulator. The ferromagnetic fluid seal was chosen over conventional mechanical sealing devices for its zero-leakage, zero-wear, and minimum friction drag characteristics, as well as its high reliability potential. G.Y.

N79-19016*# Spectrolab, Inc., Sylmar, Calif.
SOLAR PANEL ACCEPTANCE TESTING USING A PULSED SOLAR SIMULATOR **c44**
T. L. Hershey *In* NASA. Goodard Space Flight Center Ninth Conf. on Space Simulation 1977 p 27-45 (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 10A

Utilizing specific parameters as area of an individual cell, number in series and parallel, and established coefficient of current and voltage temperature dependence, a solar array irradiated with one solar constant at AMO and at ambient temperature can be characterized by a current-voltage curve for different intensities, temperatures, and even different configurations. Calibration techniques include: uniformity in area, depth and time, absolute and transfer irradiance standards, dynamic and functional check out procedures. Typical data are given for individual cell (2x2 cm) to complete flat solar array (5x5 feet) with 2660 cells and on cylindrical test items with up to 10,000 cells. The time and energy saving of such testing techniques are emphasized. Author

N79-19017*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
COMPUTER ASSISTED THERMAL-VACUUM TESTING **c14**
Ward Petrie and George Mikk *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 49-63 ref (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

In testing complex systems and components under dynamic thermal-vacuum environments, it is desirable to optimize the environment control sequence in order to reduce test duration and cost. This paper describes an approach where a computer is utilized as part of the test control operation. Real time test data is made available to the computer through time-sharing terminals at appropriate time intervals. A mathematical model of the test article and environmental control equipment is then operated on using the real time data to yield current thermal status, temperature analysis, trend prediction and recommended thermal control setting changes to arrive at the required thermal condition. The data acquisition interface and the time-sharing hook-up to an IBM-370 computer is described along with a typical control program and data demonstrating its use. G.Y.

N79-19018*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OUTER PLANETS PROBE TESTING **c15**
J. A. Smittkamp (McDonnell Douglas Astronautics Co., St. Louis, Mo.), M. G. Grote (McDonnell Douglas Astronautics Co., St. Louis, Mo.), and T. M. Edwards *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 65-83 (For primary document see N79-19013 10-12)
(Contract NAS2-9027)
Avail: NTIS HC A20/MF A01 CSCL 22B

An atmospheric entry Probe is being developed by NASA Ames Research Center (ARC) to conduct in situ scientific investigations of the outer planets' atmospheres. A full scale engineering model of an MDAC-E Probe configuration, was fabricated by NASA ARC. Proof-of-concept test validation of the structural and thermal design is being obtained at NASA ARC. The model was successfully tested for shock and dynamic loading and is currently in thermal vacuum testing. G.Y.

N79-19019*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LIGHTNING TESTS OF THE ORBITER PYROTECHNIC ESCAPE SYSTEM **c33**
R. Cohen and E. H. Schulte (McDonnell Aircraft Co., St. Louis, Mo.) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 85-103 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 09C

An experimental test program was undertaken to demonstrate that the Space Shuttle Orbiter Vehicle pyrotechnics actuated Crew Escape System was not subject to failure resulting from a lightning strike in the vicinity of the cockpit. A test sample representing a full-scale portion of the Orbiter Outer Panel was preheated to 325 F and struck with three different current waveforms to simulate the various effects of lightning: (1) 2 micro sec risetime, to 180 kA pulse to evaluate fast current rise shock effects; (2) a 205 kA, 100 micro sec wide pulse to evaluate full energy shock effects; and (3) a 490 ampere, 370 msec continuing current to evaluate the thermal effects of a lightning strike. These tests show that the Orbiter outer panel pyrotech-

nics are adequately protected against damage resulting from a lightning strike. Author

N79-19020*# Jackman (K. R.), La Jolla, Calif.
TELEMEDICINE: AN EXPANDING NEW SCIENCE ON LAND AND SEA **c52**
K. R. Jackman and Anthony J. Rippo (Marine Med. Serv., Inc., San Diego, Calif.) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 105-121 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 06E

Several medical and technical men in San Diego County are concerned with the need in many rural communities for a 24-hour day, 7-days a week access to adequate medical care. People isolated from urban areas by travel-times of 40-minutes tend to delay seeking early and effective medical care. The authors were able to assemble quality technology which permits narrow-band video-pictures, better known in the CB trade as ROBOT slow-scan television (SSTV), to be transmitted over telephone lines, by micro-wave, through satellite-bounce, or by HF-radio. These 'ROBOT' pictures can be accompanied with explanatory audio communication and with diagnostic signals from electronic instruments. G.Y.

N79-19021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF HYPODYNAMIC SIMULATIONS ON THE SKELETAL SYSTEM OF MONKEYS **c51**
D. R. Young and J. W. Tramor *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 123-140 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 06C

A research and development program was undertaken to evaluate the skeletal losses of subhuman primates in hypodynamic environments. The goals of the program are: (1) to uncover the mechanisms by which weightlessness affects the skeletal system; (2) to determine the consequences and reversibility of bone mineral losses; and (3) to acquire a body of data needed to formulate an appropriate countermeasure program for the prevention of skeletal deconditioning. Space flight experiment simulation facilities are under development and will be tested for their capability in supporting certain of the requirements for these investigations. G.Y.

N79-19022*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIRCRAFT FLIGHT SIMULATION OF SPACELAB EXPERIMENT USING AN IMPLANTED TELEMETRY SYSTEM TO OBTAIN CARDIOVASCULAR DATA FROM THE MONKEY **c51**
E. P. McCutcheon, R. Miranda, T. B. Fryer, G. Hodges, B. D. Newson, and N. Pace *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 141-153 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 06B

The utility of a multichannel implantable telemetry system for obtaining cardiovascular data was tested in a monkey with a CV-990 aircraft flight simulation of a space flight experiment. Valuable data were obtained to aid planning and execution of flight experiments using chronically instrumented animals. Author

N79-19023*# Vitro Labs., Silver Spring, Md.
NOISE IMPACT ON WILDLIFE: AN ENVIRONMENTAL IMPACT ASSESSMENT **c45**
Avi Bender *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 155-165 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 13B

Various biological effects of noise on animals are discussed and a systematic approach for an impact assessment is developed. Further research is suggested to fully quantify noise impact on the species and its ecosystem. Author

N79-19024*# Florida Univ., Gainesville.
A METHODOLOGY FOR ESTIMATING DOG NOISE IN AN ANIMAL HOUSING FACILITY **c71**
S. E. Sierens, H. A. Ingley, and E. L. Besch *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 167-177 refs (For primary document see N79-19013 10-12) (Grant RR00942)
Avail: NTIS HC A20/MF A01 CSCL 20A

A rectangular reverberation chamber was designed, constructed and calibrated for the experimental measurement of the sound power level (acoustic power) of a dog. Calibration of the chamber consisted of comparing the acoustic power measured for a random noise source in the chamber with that for the identical source in a free field environment. Data from dogs indicate that barking noise can be modeled as a square wave pattern with short duration and peak sound power levels in the 500 Hz octave band. A-weighted sound pressure levels of up to 114.7 dBA were absorbed, indicating a potential concern for both animals and man chronically exposed to such environments. Author

N79-19025*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE EFFECT OF 1 TO 5 keV ELECTRONS ON THE REPRODUCTIVE INTEGRITY OF MICROORGANISMS **c51**
J. Barengoltz and J. Brady (Bionetics Corp.) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 179-188 refs (For primary document see N79-19013 10-12) (Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 06C

Microorganisms were exposed to simulated space environment in order to assess the effect of electrons in the energy range 1 to 5 keV on their colony-forming ability. The test system consisted of an electron gun and power supply, a dosimetry subsystem, and a vacuum subsystem. The system was capable of current densities ranging from 0.1 nA/sq cm to 5 micro A/sq cm on a 25 sq on target and an ultimate vacuum of 0.0006 N/sq m (0.000004 torr). The results of the experimental program show a significant reduction in microbial reproductive integrity. Author

N79-19026*# Stillman Coll., Tuscaloosa, Ala.
DEVELOPMENTAL AND HEMATOLOGICAL RESPONSES TO LOW LEVEL CONTINUOUS EXPOSURE OF NITROGEN DIOXIDE IN MICE **c51**
Jamail Singh *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 189-196 refs (For primary document see N79-19013 10-12)
(Grant NIH-MBS-08021)
Avail: NTIS HC A20/MF A01 CSCL 06C

Young healthy mice were continuously exposed to 0ppm, 0.5ppm, 1.0ppm and 5ppm nitrogen dioxide gas for eight weeks. Nitrogen dioxide exposure for eight weeks decreased the average weight of mice, increased the average weight of lungs, heart, and brain and decreased the average weight of liver. Nitrogen dioxide exposure did not have any effects on the WBC and RBC in mice blood but it increased the HCT and HGB in mice blood. Nitrogen dioxide exposure increased the MCV and decreased the MCH and MCHC in mice blood. Author

N79-19027*# Stillman Coll., Tuscaloosa, Ala.
ELECTROPHORESIS PATTERN OF SERUM FROM MICE EXPOSED TO DIFFERENT CONCENTRATIONS OF SULFUR DIOXIDE **c51**
Jamail Singh *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 197-200 refs (For primary document see N79-19013 10-12)
(Grant NIH-MBS-08021)
Avail: NTIS HC A20/MF A01 CSCL 06C

Three day old mice were continuously exposed to sulphur dioxide concentrations at 0ppm, 0.05ppm, 0.15ppm and 1ppm for eight weeks. At the end of the experiment, blood samples were collected and centrifuged for electrophoresis studies of the serum in 5 percent acrylamide gel. The length of bands of different serum proteins from the SO2 exposed mice was at a variance as compared with the length of bands from the control exposed mice and alpha-1 band seems to be missing from the serum of SO2 exposed mice. Author

N79-19028*# Stillman Coll., Tuscaloosa, Ala.
THE EFFECTS OF THE POLLUTANT, SODIUM CYANIDE, ON THE MORPHOLOGY AND PHYSIOLOGY OF OEDOGONIUM CARDIACUM **c51**
Elbert Sparks *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 201-209 refs (For primary

document see N79-19013 10-12)
(Grant RR0802104)
Avail: NTIS HC A20/MF A01 CSCL 06C

Oedogonium cardiacum exposed to varying concentrations of sodium cyanide for 15 day periods exhibited both morphological and physiological alterations. Organisms were exposed to the pollutant in concentrations of 1, 10, 25, 50, and 100 parts per million. Exposure period for organisms in each concentration was 15 days. As the concentration of the pollutant increased fragmentation also increased. Exposure also caused organisms to lose chlorophyll. The third morphological alteration was the incidence of rupture. Physiological effects altered by exposure included: reduced oxygen evolution, retardation of starch production and death. Death occurs when organisms are exposed to high concentrations over the total 15 day period. Author

N79-19029*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
QUARTZ CRYSTAL MICROBALANCE (QCM) MONITOR OF CONTAMINATION FOR LES-8/9 **c15**
John T. Lynch *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 211-219 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 22B

A Quartz Crystal Microbalance (QCM) was used to monitor condensable contamination during the launching of two Lincoln Laboratory Experimental Satellites--LES-8 and LES-9. The QCM was installed on the dispenser truss and measured contamination by means of a frequency shift of a quartz crystal oscillator. By using a special crystal cut and a second reference quartz crystal, the sensor had extreme sensitivity and remarkable temperature independence. A 1-Hz frequency shift, which corresponds to 3.5 x 10 to the -9th power g/sq cm was resolved by the flight instrumentation. Author

N79-19030*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ESTIMATION OF OUTGASSING FROM AN EXPENDED APOGEE MOTOR AND ITS EFFECTS ON SPACECRAFT SURFACES **c44**
John J. Scialdone, John F. Rogers, and Raymond Kruger *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 221-241 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 10A

An experimental and theoretical investigation was carried out to evaluate the degradation of the solar cells and other sensitive surfaces of a spacecraft, resulting from the molecular outgassing of an expended solid propellant apogee motor. The motor, following its burnout, is retained by the spacecraft and is a source of gases and particulates which will be released mainly by the unburned propellant-to-casing insulation. The deployment of the solar array within a few minutes after the motor burn results in the interception and reflection to the surfaces of the spacecraft of the molecular outgassing and particulates. Various methods, based on some experimental data, were used to analytically assess the magnitude of the outgassing from the engine. G.Y.

N79-19031*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
THE RESPONSE OF A QUARTZ CRYSTAL MICROBALANCE TO A LIQUID DEPOSIT **c19**
A. P. M. Glassford *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 243-265 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

A theory was developed for predicting the loss of response of a QCM (Quartz Crystal Microbalance) to a liquid deposit due to viscous effects in the deposit. The loss of response is expressed by a response factor, equal to the response of the QCM to a liquid film divided by its response to a solid film of the same mass per unit area. The theory assumes a droplet-type deposit morphology, and considers the influence of droplet distribution parameters. Experiments were conducted to examine the validity of the theory, using DC 704 silicone oil as the subject deposit material. Experiments were made in two series: one with constant deposit mass and variable temperature, the other with variable deposit mass and constant temperature. Interpretation of the data using the theory has enabled information on droplet area coverage and number density to be deduced. G.Y.

N79-19032*# Ernest F. Fullam, Inc., Schenectady, N.Y.
AIRBORNE PARTICLE MONITORING BY ELECTROSTATIC PRECIPITATION **c45**
J. C. Robinson and I. T. Stoneback *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 267-275 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 13B

For qualitative analysis of atmospheric particulates by microscopy, the sampling device should preserve the particles in the state existing at the moment of capture. A collector is described that uses electrostatic precipitation to capture and disperse specimens on various substrates for direct insertion into microscopes. Sampling runs in various atmospheres are described. Micrographs are presented to show particle morphology and distribution on the substrates. Chemical identification by X-ray energy probe and electron diffraction is illustrated. Author

N79-19033*# Boeing Aerospace Co., Seattle, Wash.
THE ROLE OF LIGHT MICROSCOPY IN AEROSPACE ANALYTICAL LABORATORIES **c35**
E. R. Crutcher *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 277-287 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

Light microscopy has greatly reduced analytical flow time and added new dimensions to laboratory capability. Aerospace analytical laboratories are often confronted with problems involving contamination, wear, or material inhomogeneity. The detection of potential problems and the solution of those that develop necessitate the most sensitive and selective applications of sophisticated analytical techniques and instrumentation. This inevitably involves light microscopy. The microscope can characterize and often identify the cause of a problem in 5-15 minutes with confirmatory tests generally less than one hour. Light microscopy has and will make a very significant contribution to the analytical capabilities of aerospace laboratories. Author

N79-19034*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
KINETICS DATA FOR DIFFUSION OF OUTGAS SPECIES FROM RTV 560 **c27**
C. K. Liu and A. P. M. Glassford *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 289-308 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 07C

A detailed analytical and experimental study was made of the outgassing behavior of RTV 560 silicone rubber. The four outgas species which predominate in the temperature range of 285 K to 425 K were separately identified. The initial concentration of these species in the parent material and their bulk volatilities were determined. The diffusion coefficients and activation energy for diffusion of the two major species were deduced from outgassing rate data. It is shown that by using these data in a diffusion theory model, the outgassing rates of these major species can be predicted for arbitrary geometry and any temperature within the range studied. G.Y.

N79-19035*# European Space Technology Center, Noordwijk (Netherlands). Product Assurance Div.
EUROPEAN TESTS ON MATERIALS OUTGASSING
A. Zwaal *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 309-325 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 22A

With a view to international coordination of spacecraft materials, a number of European firms and institutes performed outgassing tests on identical materials at 125 C in high vacuum. The outgassing data obtained with the different types of equipment is presented and both the results and the critical parameters are discussed. G.Y.

N79-19036*# Martin Marietta Corp., New Orleans, La.
HIGH CURRENT LIGHTNING TEST OF SPACE SHUTTLE EXTERNAL TANK LIGHTNING PROTECTION SYSTEM **c16**

E. Mumme, A. Anderson, and E. H. Schulte (McDonnell Aircraft Co., St. Louis, Mo.) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 327-343 refs (For primary document see N79-19013 10-12)
(Contract NAS8-30300)
Avail: NTIS HC A20/MF A01 CSCL 22B

During lift-off, the shuttle launch vehicle (external tank, solid rocket booster and orbiter) may be subjected to a lightning strike. Tests of a proposed lightning protection method for the external tank and development materials which were subjected to simulated lightning strikes are described. Results show that certain of the high resistant paint strips performed remarkably well in diverting the 50 kA lightning strikes. G.Y.

N79-19037*# Okress (Ernest C.), Philadelphia, Pa.
THE PHYSICS OF GRIDDED AND CONDUCTIVE COATED DIELECTRICS FOR SPACECRAFT c33
E. C. Okress *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 345-364 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 09C

Theoretical aspects of electrostatic control and design of gridded and conductive film bonded polymers, for spacecraft Thermo-optical blankets are considered. Brief commentaries relative to the salient features of the primarily developed facility for and characterization of said polymers is also considered. Author

N79-19038*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CANCELLATION OF RESIDUAL SPACECRAFT ACCELERATIONS FOR ZERO-G SPACE PHYSICS EXPERIMENTS
James B. Stephens *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 365-373 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 22A

The Drop Dynamics Module houses an acoustic positioning system which counteracts the effects of small accelerations of a spacecraft and thus allows long-term study of free-floating materials such as liquid drops. The acoustic positioning system provides an acoustic 'well' in the center of the experiment chamber. Data collection is by cinematographic photography. The module subsystems are discussed. Author

N79-19039*# Boeing Aerospace Co., Seattle, Wash.
APPLICATION OF AN ELECTRON BEAM FACILITY FOR HEAT TRANSFER MEASUREMENTS IN CAPILLARY TUBES c34
A. R. Lunde and Ted Kramer *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 377-391 ref (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 20D

A unique method was developed for the determination of heat transfer coefficients for water flowing through capillary tubes using a rastered electron beam heater. Heat flux levels of 150 and 500 watts/sq cm were provided on the top surface of four square tubes. Temperature gradient along the tube length and mass flow rates versus pressure drop were measured. G.Y.

N79-19040*# General Electric Co., Philadelphia, Pa. ReEntry and Environmental Systems Div.
ABLATIVE PERFORMANCE OF CARBON-CARBON NOSETIPS IN SIMULATED RE-ENTRY ENVIRONMENTS c24
D. E. Nestler *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 393-406 ref (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 11D

A summary is presented of ablation performance data for carbon-carbon nosetip models obtained over a range of pressures from 10 to 168 atm. Two classes of tests are reviewed: (1) steady state, in which a constant environment is imposed on the model, and (2) ramp, in which the pressure is increased from 10 to 80 atmospheres to simulate re-entry pressure history. Comparison of arc test parameters with typical reentry vehicle parameters is included, to assess the adequacy of the test simulation. Based on this comparison, recommendations are made for facility developments which would yield improved simulation capability for reentry vehicle nosetip ablative performance. Author

N79-19041*# Martin Marietta Corp., Orlando, Fla.
HIGH TEMPERATURE STRAIN GAGE EVALUATION c35
Jose I. Gonzalez *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 407-423 refs Sponsored in part by Aeron. Systems Div., Wright-Patterson AFB, Ohio (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

The structural thermal test of an advanced ramjet missile section required strain measurements as high as 922 K (1200 F). Since there is relatively little experience in the use of strain gages above the 700-755 K (800-900 F) level, a program was initiated to select and evaluate the best available gage. Candidate gages suitable for measurements up to 922 K (1200 F) were selected. This involved the determination of their operating characteristics, availability, cost, installation aspects, etc. The evaluation involved the following tests: strain as a function of load at room temperature and apparent strain as a function of temperature. Author

N79-19042*# Naval Research Lab., Washington, D. C.
THERMAL VACUUM TESTING TECHNIQUES FOR SPACECRAFT c14
S. A. Nichols *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 425-433 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

Cesium frequency standards are to be flown on the NTS-2 satellite which is a program conducted to develop technology and time standards for NAVSTAR Global Positioning System. Mission requirements for the thermal design of this frequency standard called for a low nominal temperature (15 C) and the removal of most of the heat generated by the standard from the spacecraft. The test program run to determine the thermal properties of the frequency standard is described. A simulator was constructed for these tests. Special mathematical analysis techniques were developed and were used to predict the thermal environment for different orbital conditions. Thermal vacuum tests of the flight frequency standard and the integrated spacecraft demonstrated the validity of this technique. Author

N79-19043*# New Mexico State Univ., Las Cruces.
EVALUATION OF THERMAL SOAK TIMES c34
G. P. Mulholland and H. P. Huddleston, Jr. (White Sands Missile Range) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 435-441 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 20D

A mathematical model for the heat transfer within the electronics package of a Chaparral missile was performed. The Grashof number for this configuration was less than 2000 which indicated that the primary mode of heat transfer was conduction. The Vodicka theory for heat conduction in laminated composite media was utilized to obtain the solution for the model. G.Y.

N79-19044*# General Electric Co., Utica, N. Y. Aircraft Equipment Div.
AN EFFICIENT NUMERICAL TECHNIQUE FOR CALCULATING THERMAL SPREADING RESISTANCE c34
E. H. Gale, Jr. *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 443-456 refs (For primary document see N79-19013 10-12)
(Contract NAS8-28616)
Avail: NTIS HC A20/MF A01 CSCL 20D

An efficient numerical technique for solving the equations resulting from finite difference analyses of fields governed by Poisson's equation is presented. The method is direct (noniterative) and the computer work required varies with the square of the order of the coefficient matrix. The computational work required varies with the cube of this order for standard inversion techniques, e.g., Gaussian elimination, Jordan, Doolittle, etc. Author

N79-19045*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Nov. 1978 - Dec. 1978
15 Feb. 1979 189 p refs
(Contract NAS7-100)
(JPL-DSN-PR-42-49) Avail: NTIS HC A09/MF A01

CSCL 14B
A report is given of the Deep Space Networks progress in (1) flight project support, (2) tracking and data acquisition research and technology, (3) network engineering, (4) hardware and software implementation, and (5) operations. For individual titles, see N79-19046 through N79-19064.

N79-19046*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Feb. 1979 p 1-3 (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described. L.S.

N79-19047*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM MARK 3-77 c17
E. C. Gatz *In its* The Deep Space Network 15 Feb. 1979 p 4-10 ref (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

A description of the Deep Space Network Telemetry System, Mark III-77, and the recent improvements are provided. Telemetry functions and performance are identified. L.S.

N79-19048*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN COMMAND SYSTEM MARK 3-78 c32
H. C. Thorman *In its* The Deep Space Network 15 Feb. 1979 p 11-18 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

The Deep Space Network Command System Mark III-78 implementation and functional operation are described. Software upgrade enables expanded storage capacity in the Deep Space Station Command Processor Assembly. Store-and-forward command data handling is operational for Voyager and Helios. Near-real-time command data handling was retained for Viking and Pioneer. L.S.

N79-19049*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN GROUND COMMUNICATIONS FACILITY c32
R. H. Evans *In its* The Deep Space Network 15 Feb. 1979 p 19-28 (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

A functional description of the Ground Communications Facilities and its relationships with other elements of the Deep Space Network and NASA Communications Network is presented together with development objectives and goals and comments on implementation activities in support of flight projects. L.S.

N79-19050*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT c14
J. Allen and H. Nance *In its* The Deep Space Network 15 Feb. 1979 p 29-33 ref (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

This is a continuing Deep Space Network report on tracking and data acquisition for Project Voyager. This report covers the period from January through May 1978. Author

N79-19051*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT: DLBI WIND MEASUREMENT EXPERIMENT END-TO-END SYSTEM TEST PHASE c14
R. B. Miller *In its* The Deep Space Network 15 Feb. 1979 p 34-42 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The ten months of end-to-end system checkout for the Differential Long Base Interferometry Wind Measurement Experiment for the Pioneer Venus Mission are described. Author

N79-19052*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSILE SUPPORT c14
W. N. Jensen and J. C. Nash *In its* The Deep Space Network 15 Feb. 1979 p 43-56 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

This article reports on activities of the DSN Network Operations Organization in support of the Helios Project from 15 October through 15 December 1978. Author

N79-19053*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPARISON OF PHASE MODULATION SYSTEMS c32
J. L. Massey *In its* The Deep Space Network Feb. 1979 p 57-63 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

Comparison of the energy to noise ratio necessary to obtain a given modulation bit error probability has indicated that three-phase modulation is about 0.75 db superior to four-phase. It is shown that this apparent superiority results entirely from the greater bandwidth required by the three-phase system for the same bit transmission rate. Two further comparison criteria are proposed, which are based on the cut-off rate R sub 0 of the discrete channel created by the modulation system. For the criterion which constrains both the bandwidth and transmitted power, it is shown that four-phase modulation is always superior to three-phase modulation. The conclusion is that three-phase modulation offers no practical advantage over four-phase modulation. Author

N79-19054*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUBMICROSECOND COMPARISON OF INTERCONTINENTAL CLOCK SYNCHRONIZATION BY VLBI AND THE NTS SATELLITE c32
W. J. Hurd, S. C. Wardrip, J. Bussion (Naval Research Lab., Washington, D. C.), J. Oaks (Naval Research Lab., Washington, D. C.), T. McCaskill (Naval Research Lab., Washington, D. C.), H. Warren (Bendix Field Engineering Corp.,), and G. Whitworth (Applied Physics Lab., Johns Hopkins Univ., Baltimore) *In its* The Deep Space Network 15 Feb. 1979 p 64-69 refs Prepared in part by NASA Goddard Space Flight Center. (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

The intercontinental clock synchronization capabilities of Very Long Baseline Interferometry (VLBI) and the Navigation Technology Satellite (NTS) were compared in May 1978 by using both methods to synchronize the cesium clocks at the NASA Deep Space Net complexes at Madrid, Spain, and Goldstone, California. The VLBI experiments used the Wideband VLBI Data Acquisition System. The Navigation Technology Satellites were used with NTS Timing Receivers developed by the Goddard Space Flight Center. The two methods agreed at about the one-half microsecond level. The VLBI system also obtained long-term stability information on the HP5061A004 cesium standards by measuring delta T/T over four 3- to 4-day intervals, obtaining stability estimates of (1 + or - 1)x10 to the -13th power for the combined timing systems. L.S.

N79-19055*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CODING FOR OPTICAL CHANNELS c32
L. D. Baumert (Arizona State Univ.), R. J. McEliece (Illinois Univ.), and H. Rumsey, Jr. *In its* The Deep Space Network 15 Feb. 1979 p 70-77 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

In a previous paper Pierce considered the problem of optical communication from a novel viewpoint, and concluded that performance will likely be limited by issues of coding complexity rather than by thermal noise. This paper reviews the model proposed by Pierce and presents some results on the analysis and design of codes for this application. L.S.

N79-19056*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INITIAL ECONOMIC AND OPERATIONS DATA BASE FOR DSS 13 AUTOMATION TEST c60
D. S. Remer and G. Lorden *In its* The Deep Space Network 15 Feb. 1979 p 78-85 ref (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

A summary is given of the data base collected for nine weeks of Deep Space Station 11. Life cycle cost parameters on efficiency and productivity ratios, costs, and telemetry were calculated from this data base. L.S.

N79-19057*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LS47: A DSN STATION LOCATION SET COMPATIBLE WITH

JPL DEVELOPMENT EPHEMERIS DE108 **c43**

J. Ellis *In its* The Deep Space Network 15 Feb. 1979 p 86-98 refs (For primary document see N79-19045 10-12)

Avail: NTIS HC A09/MF A01 CSCL 08B

An updated Deep Space Network station location set, LS47, is presented which is compatible with JPL Development Ephemeris DE108. Analytic procedures for linearly correcting station spin axis and longitude estimates for an ephemeris update based on Brouwer-Clemence Set III parameters are briefly discussed. The validity of this technique is demonstrated by a comparison of a linearly corrected solution with one explicitly determined by reprocessing the data. A mission data base, including Viking 1 and 2 encounter data, is first used to obtain an updated DE96 compatible station location solution, LS46, which in turn is adjusted to form the DE108 solution, LS47. Improved station Z-heights are estimated by using available very long baseline interferometry data. Spin axis differences between LS46 and LS47 are relatively insignificant; however, the ephemeris change introduces a -0.8 x 10 to the -5 power degree rotation in the DE96 longitude ephemeris. L.S.

N79-19058*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

RADIO FREQUENCY CARRIER ARRAYING FOR NEAR MAXIMUM CARRIER SIGNAL-TO-NOISE RATIO IMPROVEMENT **c32**

M. H. Brockman *In its* The Deep Space Network 15 Feb. 1979 p 99-106 refs (For primary document see N79-19045 10-12)

Avail: NTIS HC A09/MF A01 CSCL 17B

Radio frequency arraying of several receiving systems provides signal-to-noise ratio improvement relative to a single receiving system. This report considers radio frequency carrier arraying which provides near maximum signal-to-noise ratio improvement for carrier reception and demodulation. Author

N79-19059*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE UPDATED ALGORITHM OF THE ENERGY CONSUMPTION PROGRAM (ECP): A COMPUTER MODEL SIMULATING HEATING AND COOLING ENERGY LOADS IN BUILDINGS **c44**

F. L. Lansing, D. M. Strain, V. W. Chai, and S. Higgins *In its* The Deep Space Network 15 Feb. 1979 p 107-115 (For primary document see N79-19045 10-12)

Avail: NTIS HC A09/MF A01 CSCL 10B

The energy Comsumption Computer Program was developed to simulate building heating and cooling loads and compute thermal and electric energy consumption and cost. This article reports on the new additional algorithms and modifications made in an effort to widen the areas of application. The program structure was rewritten accordingly to refine and advance the building model and to further reduce the processing time and cost. The program is noted for its very low cost and ease of use compared to other available codes. The accuracy of computations is not sacrificed however, since the results are expected to lie within + or - 10% of actual energy meter readings. Author

N79-19060*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A TWO-DIMENSIONAL THERMAL ANALYSIS OF A NEW HIGH-PERFORMANCE TUBULAR SOLAR COLLECTOR **c44**

F. L. Lansing and C. S. Yung *In its* The Deep Space Network 15 Feb. 1979 p 116-131 refs (For primary document see N79-19045 10-12)

Avail: NTIS HC A09/MF A01 CSCL 10A

The first of two articles are presented which describe and analyze the thermal performance of a vacuum tube solar collector. The assumptions and mathematical modeling are presented. The problem is reduced to the formulation of two simultaneous linear differential equations characterizing the collector thermal behavior. After applying the boundary conditions, a general solution is obtained which is found similar to the general Hottel, Whillier and Bliss form but with a complex flow factor. L.S.

N79-19061*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

AUTOMATIC FILAMENT WARM-UP CONTROLLER **c33**

J. McCluskey and J. Daeges *In its* The Deep Space Network 15 Feb. 1979 p 132-133 (For primary document see N79-19045 10-12)

Avail: NTIS HC A09/MF A01 CSCL 09A

As part of the unattended operations objective of the Deep Space Network deep space stations, this filament controller serves as a step between manual operation of the station and complete computer control. Formerly, the operator was required to devote five to fifteen minutes of his time just to properly warm up the filaments on the klystrons of the high power transmitters. The filament controller reduces the operator's duty to a one-step command and is future-compatible with various forms of computer control. Author

N79-19062*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DSN WATER VAPOR RADIOMETER: TROPOSPHERIC RANGE DELAY CALIBRATION **c35**

S. D. Slobin and P. D. Batelaan *In its* The Deep Space Network 15 May 1979 p 136-145 refs (For primary document see N79-19045 10-12)

Avail: NTIS HC A09/MF A01 CSCL 14B

A discussion is presented of the Deep Space Network water vapor radiometer by means of simultaneous antenna temperature and radiosonde measurements at Edwards Air Force Base. The calibration of radiometer gain and hot load radiometric noise temperature is also described. Calibration equations are given. It is found that with a selected data set, the RMS error is less than 1 cm over a total delay range of 9 to 38 cm. Limitations on the use of the water vapor radiometer are also given. L.S.

N79-19063*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

FTS MAINTENANCE AND CALIBRATION AT DSS 42/43 **c14**

P. R. Dachel and J. Wells *In its* The Deep Space Network 15 Feb. 1979 p 146-154 refs (For primary document see N79-19045 10-12)

Avail: NTIS HC A09/MF A01 CSCL 14B

An FTS maintenance and calibration task was conducted at DSS 42/43 during August 1978. The objectives of this effort were (1) the routine maintenance and calibration of hydrogen masers, (2) installation and calibration of cesium standards, (3) installation of test equipment for frequency measurement, (4) CRG testing, (5) cabling inspection and repair, (6) check thermal and magnetic environment of H-maser/cesium room, and (7) calibration of frequency and timing subsystem. Author

N79-19064*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A MAXIMUM LIKELIHOOD CONVOLUTIONAL DECODER MODEL vs EXPERIMENTAL DATA COMPARISON **c17**

R. Y. Chen *In its* The Deep Space Network 15 Feb. 1979 p 155-159 (For primary document see N79-19045 10-12)

Avail: NTIS HC A09/MF A01 CSCL 17B

This article describes the comparison of a maximum likelihood convolutional decoder (MCD) prediction model and the actual performance of the MCD at the Madrid Deep Space Station. The MCD prediction model is used to develop a subroutine that has been utilized by the Telemetry Analysis Program (TAP) to compute the MCD bit error rate for a given signal-to-noise ratio. The results indicate that that the TAP can predict quite well compared to the experimental measurements. An optimal modulation index also can be found through TAP. Author

N79-19065*# Martin Marietta Corp., Denver, Colo.

INTEGRATED ORBITAL SERVICING STUDY FOLLOW-ON. VOLUME 1: EXECUTIVE SUMMARY Final Report

W. L. DeRocher, Jr. Jun. 1978 55 p 3 Vol.

(Contract NAS8-30820)

(NASA-CR-150890; MCR-77-246-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 22A

Orbital maintenance concepts were investigated and the equipment for one-g demonstrations of axial and radial module exchange was designed in three control modes: manual direct control, supervisory control, and manually augmented control. Significant results obtained and the conclusions drawn are presented and discussed. The overall conclusion is that on-orbit servicing should be established as an ongoing space transportation system capability. J.M.S.

N79-19066*# Martin Marietta Corp., Denver, Colo.

INTEGRATED ORBITAL SERVICING STUDY FOLLOW-ON.

VOLUME 2: TECHNICAL ANALYSIS AND SYSTEM DESIGN
Final Report
Apr. 1978 404 p 3 Vol.
(Contract NAS8-30820)
(NASA-CR-150891; MCR-77-246-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 22A

In-orbit service functional and physical requirements to support both low and high Earth orbit servicing/maintenance operations were defined, an optimum servicing system configuration was developed and mockups and early prototype hardware were fabricated to demonstrate and validate the concepts selected. Significant issues addressed include criteria for concept selection; representative mission equipment and approaches to their design for serviceability; significant serviceable spacecraft design aspects; servicer mechanism operation in one-g; approaches for the demonstration/simulation; and service mechanism structure design approach. A.R.H.

N79-19067*# Martin Marietta Corp., Denver, Colo.
INTEGRATED ORBITAL SERVICING STUDY FOLLOW-ON. VOLUME 3: ENGINEERING TEST UNIT AND CONTROLS
Final Report
Jun. 1978 98 p refs 3 Vol.
(Contract NAS8-30820)
(NASA-CR-150892; MCR-77-246-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 22A

A one-g servicing demonstration system which can be used to investigate and develop, in a real time hands-on situation, a wide variety of the mechanism and control system aspects of orbital servicing in the form of module exchange is described including the engineering test unit and the servicer servo drive console. A series of recommendations for future work is given concerning the control problem and more efficient module exchanges, mechanical elements, and electronics. J.M.S.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N79-19015*# Hughes Aircraft Co., El Segundo, Calif.
DEVELOPMENT OF A FERROMAGNETIC ROTARY VACUUM SEALED SPACECRAFT SPIN FIXTURE
M. B. Levine *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 15-23 Sponsored in part by Intern. Telecommun. Satellite Organ. (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

N79-19017*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
COMPUTER ASSISTED THERMAL-VACUUM TESTING
Ward Petrie and George Mikk *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 49-63 ref (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

N79-19042*# Naval Research Lab., Washington, D. C.
THERMAL VACUUM TESTING TECHNIQUES FOR SPACECRAFT
S. A. Nichols *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 425-433 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

N79-19046*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Feb. 1979 p 1-3 (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N79-19060*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT
J. Allen and H. Nance *In its* The Deep Space Network 15 Feb. 1979 p 29-33 ref (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N79-19061*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT: DLBI WIND MEASUREMENT EXPERIMENT END-TO-END SYSTEM TEST PHASE
R. B. Miller *In its* The Deep Space Network 15 Feb. 1979 p 34-42 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N79-19052*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSILE SUPPORT
W. N. Jensen and J. C. Nash *In its* The Deep Space Network 15 Feb. 1979 p 43-56 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N79-19063*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FTS MAINTENANCE AND CALIBRATION AT DSS 42/43
P. R. Dachel and J. Wells *In its* The Deep Space Network 15 Feb. 1979 p 146-154 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-19068*# Analytical and Computational Mathematics, Inc., Houston, Tex.
PERTURBATIONS OF NON-RESONANT SATELLITE ORBITS DUE TO A ROTATING EARTH
Alan Mueller Jun. 1978 43 p refs
(Contract NAS9-15445)
(NASA-CR-160129; ACM-TR-112) Avail: NTIS HC A03/MF A01 CSCL 22A

The dominant perturbations of the motion of a satellite near the earth are due to atmospheric drag and the non-symmetrical gravitational field. Atmospheric drag perturbation continually pulls the satellite in and out of the different long period resonant frequencies. The result is that the resonances never become apparent and may be neglected. The tesseral harmonics have no true secular perturbation but the periodicities in the mean motion induce a secular perturbation in the mean anomaly. This secular perturbation may be determined by simply using the average mean motion instead of the osculating mean motion. The Von Ziepel method is used to determine tesseral perturbations. The solution is found first in the singular DS phi elements and then rewritten in the PS phi elements to remove singularities. The notation used in the development is described in the appendix. A.R.H.

N79-19069*# Martin Marietta Corp., Denver, Colo.
STUDY OF ALTERNATIVE PROBE TECHNOLOGIES
Final Report
Dec. 1977 196 p refs
(Contract NAS2-9635)

(NASA-CR-152242; MCR-77-311) Avail: NTIS HC A09/MF A01 CSCL 22B

A number of implied technologies for a deep probe mission was examined; i.e., one that would provide the capability to scientifically examine planetary atmospheres at the 1000 bar level. Conditions imposed by current Jupiter, Saturn, and Uranus atmospheric models were considered. The major thrust of the measurements was to determine lower atmosphere composition, even to trace constituents of one part per billion. Two types of instruments having the necessary accuracy to meet the science objectives were considered and integrated into a deep probe configuration. One deep probe option that resulted was identified as a Minimum Technology Development approach. The significant feature of this option is that only three technology developments are required to enable the mission, i.e., (1) science instrument development, (2) advanced data processing, and (3) external high pressure/thermal insulation. It is concluded that a probe designed for a Jupiter mission could, with minor changes, be used for a Saturn or Uranus mission. Author

N79-19070*# Analytical and Computational Mathematics, Inc., Houston, Tex.
LONG PERIOD PERTURBATIONS OF EARTH SATELLITE ORBITS
K. C. Wang Jan. 1979 27 p
(Contract NAS9-15445)
(NASA-CR-160130; ATM-TR-116) Avail: NTIS HC A03/MF A01 CSCL 22A

All the equations involved in extending the PS phi solution to include the long periodic and second order secular effects of the zonal harmonics are presented. Topics covered include DSphi elements and relations for their conconical transformation into the PS phi elements; the solution algorithm based on the Von Zeipel method; and the elimination of long periodic terms and analytical integration of primed variables. The equations were entered into the ASOP program, checked out, and verified. Comparisons with numerical integrations show the long period theory to be accurate within several meters after 800 revolutions. A.R.H.

N79-19071*# Rockwell International Corp., Downey, Calif. Satellite Systems Div.
SATELLITE POWER SYSTEM (SPS) CONCEPT DEFINITION STUDY (EXHIBIT C) Final Review
G. M. Haley 21 Mar. 1979 477 p refs
(Contract NAS8-32475)
(NASA-CR-161173; SSD-79-0076) Avail: NTIS HC A21/MF A01 CSCL 22B

The major outputs of the study are the constructability studies which resulted in the definition of the concepts for satellite, rectenna, and satellite construction base construction. Transportation analyses resulted in definition of heavy-lift launch vehicle, electric orbit transfer vehicle, personnel orbit transfer vehicle, and intra-orbit transfer vehicle as well as overall operations related to transportation systems. The experiment/verification program definition resulted in the definition of elements for the Ground-Based Experimental Research and Key Technology plans. These studies also resulted in conceptual approaches for early space technology verification. The cost analysis defined the overall program and cost data for all program elements and phases. G.Y.

N79-19072# Bendix Aerospace Systems Div., Mishawaka, Ind.
DIGITAL ELECTROHYDRAULIC STEPPER ACTUATOR FOR ADVANCED MISSILE SYSTEMS Final Report, Mar. 1974 - Feb. 1978
Jack M. Silvius and Eugene A. Sherrill Jun. 1978 161 p refs
(Contract F33615-74-C-2052)
(AD-A061693; AFAPL-TR-78-42) Avail: NTIS HC A08/MF A01 CSCL 09/5

A high performance digital electrohydraulic stepper actuator was designed, fabricated, and tested. Performance and space requirements were derived from design studies for the Multipurpose Missile. The design provides digital interface compatibility while achieving the required performance characteristics. The actuator performed well at the rated conditions of 140 degrees per second and 1333 inch pounds load. No load speed achieved during test was over twice as great as the 250 degrees per second required. Stall torque exceeded the 2000 inch pounds design requirement. The actuator has yet to be evaluated at the 600 F design environment. GRA

N79-19018*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OUTER PLANETS PROBE TESTING
J. A. Smittkamp (McDonnell Douglas Astronautics Co., St. Louis, Mo.), M. G. Grote (McDonnell Douglas Astronautics Co., St. Louis, Louis, Mo.), and T. M. Edwards *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 65-83 (For primary document see N79-19013 10-12)
(Contract NAS2-9027)
Avail: NTIS HC A20/MF A01 CSCL 22B

N79-19029*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
QUARTZ CRYSTAL MICROBALANCE (QCM) MONITOR OF CONTAMINATION FOR LES-8/9
John T. Lynch *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 211-219 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-18887*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE ORBITAL FLIGHT TESTING
Henry W. Hartsfield, Jr. *In* SETP SETP Tech. Rev., Vol. 14, No. 2 1979 p 11-20 (For primary document see N79-18885 10-01)
Avail: NTIS HC A10/MF A01 CSCL 22B

N79-19036*# Martin Marietta Corp., New Orleans, La.
HIGH CURRENT LIGHTNING TEST OF SPACE SHUTTLE EXTERNAL TANK LIGHTNING PROTECTION SYSTEM
E. Mumme, A. Anderson, and E. H. Schulte (McDonnell Aircraft Co., St. Louis, Mo.) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 327-343 refs (For primary document see N79-19013 10-12)
(Contract NAS8-30300)
Avail: NTIS HC A20/MF A01 CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N79-19047*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM MARK 3-77
E. C. Gatz *In its* The Deep Space Network 15 Feb. 1979 p 4-10 ref (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N79-19064*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MAXIMUM LIKELIHOOD CONVOLUTIONAL DECODER MODEL vs EXPERIMENTAL DATA COMPARISON
R. Y. Chen *In its* The Deep Space Network 15 Feb. 1979 p 155-159 (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

No abstracts in this category.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N79-19031*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
THE RESPONSE OF A QUARTZ CRYSTAL MICROBALANCE TO A LIQUID DEPOSIT
A. P. M. Glassford *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 243-265 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-19073*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
STRUCTURAL ANALYSIS OF CYLINDRICAL THRUST CHAMBERS, VOLUME 1 Final Report, May 1978 - Mar. 1979
W. H. Armstrong Mar. 1979 52 p refs
(Contract NAS3-21361)
(NASA-CR-159522; LMSC-HREC-TR-D568827-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21H

Life predictions of regeneratively cooled rocket thrust chambers are normally derived from classical material fatigue principles. The failures observed in experimental thrust chambers do not appear to be due entirely to material fatigue. The chamber coolant walls in the failed areas exhibit progressive bulging and thinning during cyclic firings until the wall stress finally exceeds the material rupture stress and failure occurs. A preliminary analysis of an oxygen free high conductivity (OFHC) copper cylindrical thrust chamber demonstrated that the inclusion of cumulative cyclic plastic effects enables the observed coolant wall thinout to be predicted. The thinout curve constructed from the referent analysis of 10 firing cycles was extrapolated from the tenth cycle to the 200th cycle. The preliminary OFHC copper chamber 10-cycle analysis was extended so that the extrapolated thinout curve could be established by performing cyclic analysis of deformed configurations at 100 and 200 cycles. Thus the original range of extrapolation was reduced and the thinout curve was adjusted by using calculated thinout rates at 100 and 100 cycles. An analysis of the same underformed chamber model constructed of half-hard Amzirc to study the effect of material properties on the thinout curve is included. A.R.H.

N79-19074*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ADVANCED ENGINE STUDY FOR MIXED-MODE ORBIT-TRANSFER VEHICLES Final Report
J. A. Mellish Dec. 1978 228 p refs
(Contract NAS3-21049)
(NASA-CR-159491) Avail: NTIS HC A11/MF A01 CSCL 21H

Engine design, performance, weight and envelope data were established for three mixed-mode orbit-transfer vehicle engine candidates. Engine concepts evaluated are the tripropellant, dual-expander and plug cluster. Oxygen, RP-1 and hydrogen are the propellants considered for use in these engines. Theoretical performance and propellant properties were established for bipropellant and tripropellant mixes of these propellants. RP-1, hydrogen and oxygen were evaluated as coolants and the maximum attainable chamber pressures were determined for each engine concept within the constraints of the propellant properties and the low cycle thermal fatigue (300 cycles) requirement. The baseline engine design and component operating characteristics are determined at a thrust level of 88,964N (20,000 lbs) and a thrust split of 0.5. The parametric data is generated over ranges of thrust and thrust split of 66.7 to 400kN (15 to 90 klb) and 0.4 to 0.8, respectively. A.R.H.

N79-19075*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
SOLID ROCKET BOOSTER THERMAL PROTECTION SYSTEM MATERIALS DEVELOPMENT Final Report
William G. Dean Dec. 1978 31 p
(Contract NAS8-31555)
(NASA-CR-161171; LMSC-HREC-TR-D568533) Avail: NTIS HC A03/MF A01 CSCL 21H

A complete run log of all tests conducted in the NASA-MSFC hot gas test facility during the development of materials for the space shuttle solid rocket booster thermal protection system are presented. Lists of technical reports and drawings generated under the contract are included. A.R.H.

N79-19076# Naval Research Lab., Washington, D. C.
ULTRASONIC MEASUREMENT OF MOTOR CASE INSULATION THICKNESS Final Report
Stephen D. Hart Sep. 1978 9 p refs
(AD-A061753; NRL-MR-3859) Avail: NTIS HC A02/MF A01 CSCL 21/8

An ultrasonic technique for measuring the insulator thickness of a missile motor case before and after firing was devised. The ultrasonic approach is simple, quick, and inexpensive.
Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-19077 Johns Hopkins Univ., Baltimore, Md.
INTERACTIONS IN THE EXCITED STATE Ph.D. Thesis
Maria Concepcion Tamargo 1978 118 p
Avail: Univ. Microfilms Order No. 7906499

The interactions of the aromatic hydrocarbons anthracene and 9,10 dichloranthracene (DCA) with heavy atom solvents (ethyl iodide = Q) exhibit a normal heavy atom effect. This consists of a quenching of the fluorescence yield, a corresponding enhancement of the triplet yield and an enhancement of the triplet decay rates. A systematic study of the room temperature interactions of DCA and ethyl iodide was carried out in cyclohexane and the rate parameters of the heavy atom assisted processes were evaluated. Dissert. Abstr.

N79-19078# Oklahoma Univ., Norman. Dept. of Chemistry.
COLORED AND COLORLESS TIN 2 AMINES
Peter J. Corvan and J. J. Zuckerman 1978 15 p
(Contract N00014-77-C-0432)
(AD-A061642; TR-7) Avail: NTIS HC A02/MF A01 CSCL 07/3

Intensely colored tin(II) amines are monomeric species with larger tin-119m Moessbauer isomer shifts and quadrupole splittings than their more air stable colorless analogues whose

less sterically demanding amine substituents allow intermolecular coordination through bridging nitrogen atoms; the crossover point between these two limiting situations is defined by the synthesis of several series of tin(II) amine compounds.
Author (GRA)

N79-19079# Pennsylvania State Univ., University Park. Dept. of Chemistry
PROPERTIES OF REACTIVE ATOMIC SPECIES GENERATED AT HIGH TEMPERATURES AND THEIR LOW TEMPERATURE REACTIONS TO FORM NOVEL SUBSTANCES Final Report, 1 Oct. 1974 - 31 May 1978
Philip S. Skell 1978 6 p
(Grant AF-AFOSR-2748-75)
(AD-A062054; AFOSR-78-1497TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

A 44 mo. program of research is described which involved the generation of atomic species of a number of chemical elements and their reactions with organic compounds to form organometallic compounds.
Author (GRA)

N79-19080# University of Southern California, Los Angeles.
A STUDY OF PHOTOPHYSICAL PROCESSES IN ORGANIC SYSTEMS Final Report, 1 Apr. 1975 - 30 Sep. 1978
Lawrence A. Singer Oct. 1978 7 p refs
(Grant DAAK29-75-G-0093)
(AD-A062075; ARO-12816.9-C) Avail: NTIS HC A02/MF A01 CSCL 07/3

This report summarizes research results covering the topics: the role of exciplexes in the photophysics of aromatic ketone triplets, triplet-triplet annihilation of aromatic ketone triplets, exploratory studies on photorotamerism in glassy media, exploratory studies of the photophysics of rigid 1,2-diketones, and elucidation of the chemiexcitation pathways in the decomposition of 1,2-dioxetanes.
Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N79-19081 California Univ., Berkeley.
PORE STRUCTURE AND GROWTH KINETICS IN CARBON MATERIALS Ph.D. Thesis
Sudhangshu Bose 1978 82 p
Avail: Univ. Microfilms Order No. 7904384

The microstructure of glassy carbon was characterized using X-ray diffraction and high resolution electron microscopy. Small angle X-ray scattering was used to measure the angstrom sized pores and to follow the evolution of pore surface area as a function of heat treatment temperature and heat treatment time at constant temperature. From these measurements an analysis of the surface area kinetics was made to find out if rate processes are involved and to locate graphitization occuring at pore surfaces. Pyrolytic graphite on the other hand has larger sized pores that comprise five percent of its volume. In addition to being closed these pores are oriented. Some pore models are proposed for PG and the existing scattering theory from oriented ellipsoids is modified to include the proposed shapes.
Dissert. Abstr.

N79-19082# Brookhaven National Lab., Upton, N. Y.
AN ASSESSMENT OF THERMAL INSULATION MATERIALS AND SYSTEMS FOR BUILDING APPLICATIONS
Jun. 1978 299 p refs Prepared in cooperation with Dynatech R/D Corp.
(Contract EY-76-C-02-0016)
(BNL-50862) Avail: NTIS MF A01; SOD HC

Seven major generic types of insulation were identified, based upon the nature of the material used: mineral fiber (glass, rock, and slag), cellulose, cellular plastics, perlite, vermiculite, reflective surfaces, and insulating concrete. Over 400 manufacturers of insulation materials provided information concerning the thermal performance, fire performance, water vapor transmission, density and mechanical properties of their products. All available information, including resonses to questionaires, manufacturers' literature, open literature, and the knowledge of experts was used in the assessment. Topics covered include: thermal properties and factors affecting insulation performance; validity of data; material properties; certification and inspectioh; residential, industrial and commercial insulation assemblies; present status and future requirements for thermal insulation testing; and restrictions and influences of standards and building codes on building envelope systems. Specific recommendations which require immediate attention are presented.
A.R.H.

N79-19083*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
ANALYSIS OF GRAPHITE/POLYIMIDE RAIL SHEAR SPECIMENS SUBJECTED TO MECHANICAL AND THERMAL LOADING Final Report
Terry A. Weisshaar and Ramon Garcia Mar. 1979 56 p refs
(Grant NGR-47-004-129)
(NASA-CR-3106; VPI-E-78-27) Avail: NTIS HC A04/MF A01 CSCL 11D

A two-dimensional, linear-elastic, finite element analysis of selected graphite/polyimide rail shear test specimens was made to determine the mechanical loading and the effect of heating the specimen to a uniform temperature. The presence of specimen free edges and their influence on the accuracy of the rail shear test is discussed. Parameters include the length-to-width ratio of the specimen and the ply layup for symmetric, balanced laminates. Results presented include shear and normal stress distributions and the deflection behavior of various specimens caused by the mechanical loading and elevated temperature.
A.R.H.

N79-19084# Fiber Science, Inc., Gardena, Calif.
SPACEWOUND COMPOSITE STRUCTURES Final Report, Jan. - Nov. 1977
Dale Abildskov and Sam Yao Jan. 1978 112 p
(Contract DAAJ02-77-C-0016)
(AD-A061744) Avail: NTIS HC A06/MF A01 CSCL 11/2

The objective of this program was to investigate the potential of the space-wound structural concept to provide a ballistic tolerant structure to the high explosive projectile. The spacewound structural concept, developed by Fiber Science, Inc., is an open weave wet filament wound composite structural concept which has the potential for venting the blast pressure from the high explosive projectile while at the same time providing a multiplicity of redundant load paths. Twelve 24-inch diameter cylindrical specimens were designed and fabricated by Fiber Science, Inc., and were subsequently ballistically tested at the Applied Technology Laboratory, Fort Eustis, Virginia. Three materials (Kevlar, Fiberglass, and Graphite), two fiber coverage ratios, and the use of an external fiberglass aerodynamic skin surface were assessed. Based on the results of these tests, four Kevlar specimens with a fiberglass cloth skin, two with 25% and two with 50% fiber coverage ratio, were selected for final design evaluation. The final specimens were 16-inch diameter cylinders with a four-bolt ring/frame attachment fitting at each end to facilitate structural testing.
GRA

N79-19085# Delaware Univ., Newark. Dept of Mechanical and Aerospace Engineering.
ANALYSIS AND DESIGN OF COMPOSITE BONDED JOINTS UNDER A DYNAMIC TYPE LOAD Final Report, Jun. 1974 - May 1978
Jack R. Vinson Aug. 1978 26 p refs
(Grant AF-AFOSR-2739-74; AF Proj. 2307)
(AD-A061978; AFOSR-78-1512TR) Avail: NTIS HC A03/MF A01 CSCL 13/5

This report discusses the results of four years of work under the referenced grant. Principal effort was in the title area, with some work in these subsidiary areas: response of spherical and cylindrical shells to localized loads, determination of interlaminar shear and normal stresses in laminated composite shells, the analysis, design and optimization of bonded joints in composite constructions; including the determination of shear properties of promising adhesives, review of the state of technology in mechanical fasteners in composite structures, and the response of many constructions to hygrothermal loadings.
GRA

N79-19086# General Electric Co., Schenectady, N. Y.
DEVELOPMENT OF A SINTERING PROCESS FOR HIGH-PERFORMANCE SILICON NITRIDE Final Report, 15 Mar.

1977 - 15 Mar. 1978
S. Prochazka and C. D. Greskovich Jul. 1978 97 p refs
(Contract DAAG46-77-C-0030)
(AD-A061880; SRD-77-178; AMMRC-TR-78-32) Avail: NTIS HC A05/MF A01 CSCL 11/2

Beta-Si3N4 ceramics with excellent creep and oxidation resistance in the temperature range of 1300 to 1450 C can be produced by the sintering process using small amounts (3-7%) of BeSiN2 as a densification aid. These ceramics are composed of both elongated and equi-axed grains of Beta-Si3N4 solid solution and sometimes contain minor amounts of Si, SiC and BeSiN2, depending on starting composition and sintering conditions. Although samples have been occasionally sintered to 98% relative density, densities near 90% are routinely produced by sintering at 2000-2100 C for 15 min. in 60-80 atm of N2. In addition to optimum amounts of Be and O required for the attainment of high density and consequently, good thermochemical properties of the ceramic, effects of metallic impurities (Ca, Mg and Fe which promote sintering) have been observed. The thermodynamic stability of Si3N4 is outlined and the 'region of sinterability' is established for submicron alpha-Si3N4 powders containing small amounts of BeSiN2. Proposed chemical reactions and mechanism of densification during sintering are discussed.
Author (GRA)

N79-19087# Vought Corp. Advanced Technology Center, Inc., Dallas, Tex.
THE EFFECT OF ENVIRONMENT ON THE MECHANICAL BEHAVIOR OF AS/3501-6 GRAPHITE/EPOXY MATERIAL Final Report, Jun. 1977 - Jun. 1978
W. J. Renton and T. Ho Aug. 1978 91 p refs
(Contract N00019-77-C-0369)
(AD-A061912; ATC-B-92100/8CR-105) Avail: NTIS HC A05/MF A01 CSCL 11/4

Applicability of linear viscoelasticity to the characterization of AS/3501-6 Graphite/Epoxy material under severe environment was investigated in this Phase I program. Specific studies included development of master curves reflecting material dependence on time, temperature and humidity and resolution of the question as to whether a specific thermal conditioning environment can be directly substituted for a specific moisture conditioning environment over a prescribed temperature vs. humidity range.
GRA

N79-19040*# General Electric Co., Philadelphia, Pa. ReEntry and Environmental Systems Div.
ABLATIVE PERFORMANCE OF CARBON-CARBON NOSETIPS IN SIMULATED RE-ENTRY ENVIRONMENTS
D. E. Nestler *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 393-406 ref (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N79-19088 California Inst. of Tech., Pasadena.
ANGULAR DISTRIBUTIONS IN PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
Jeffrey Alan Sell 1979 304 p
Avail: Univ. Microfilms Order No. 7904854

Measurements of the angular distributions in the photoelectron spectroscopy of diatomic and polyatomic molecules are described. The apparatus was constructed previously, and basically consisted of a HeI radiation source, a scattering chamber, a set of electrostatic lenses, a 180 deg hemispherical electrostatic kinetic energy analyzer, and detector. The lenses, analyzer, and detector were mounted on a gear and rotate about the center of the scattering chamber, allowing the measurements of the photoelectron angular distributions. The theoretical section outlined the quantum mechanics of the photoionization process and briefly described recent attempts to calculate the photoelectron asymmetry parameter beta for atoms and molecules. The results for the hydrogen molecule were compared to the experimental values measured with fairly good agreement.
Dissert. Abstr.

N79-19089 Cincinnati Univ., Ohio.
UTILIZATION OF ELEMENTAL HYDRIDE GENERATION IN ATOMIC SPECTROSCOPIC ANALYSIS Ph.D. Thesis
Wayne Brian Robbins 1978 159 p
Avail: Univ. Microfilms Order No. 7904763

A sodium borohydride/acid reaction used to generate volatile elemental hydrides is coupled with a microwave induced plasma for utilization in analytical atomic spectroscopy. In coupling the hydride generation reaction to the microwave induced plasma, there were three basic stages of development. The first stage involved coupling the reaction directly to the plasma. This approach was unsuccessful due to the prohibitively high hydrogen flow rate during the reaction. The second stage involved a coupling via preliminary liquid nitrogen condensation. This stage was only marginally acceptable since reagent purification was necessary to eliminate substances which cause spectral background interferences. The final stage of development was a coupling via preliminary liquid nitrogen condensation followed by a chromatographic separation of the substances causing spectral background interference from the analyses of interest.
Dissert. Abstr.

N79-19090 Purdue Univ., Lafayette, Ind.
INVESTIGATIONS OF TWO-PHOTON SPECTROSCOPY FOR CHEMICAL ANALYSIS Ph.D. Thesis
Mary Jean Wirth 1978 192 p
Avail: Univ. Microfilms Order No. 7905798

A two-fold approach is taken in the investigation of the analytical aspects of two photon spectroscopy. A novel laser source was introduced and characterized as an expedient means of achieving two-photon absorption; and two photon excited flourescence spectroscopy was demonstrated as a promising method for chemical analysis, with a diversity of applications. The high peak power and continuous nature of the synchronously pumped cw dye laser allows the generation of a sensitive and precise two photon excitation response, and the wide tunability range allows acquisition of two photon excitation spectra. It was determined that the cavity dumped version of the laser yields the best performance for two photon spectroscopy and offers the most versatile output method. Dissert. Abstr.

N79-19091 Stanford Univ., Calif.
EXCITED STATE INTERACTIONS IN THE ELECTRONIC SPECTROSCOPY OF LINEAR POLYENES Ph.D. Thesis
John Richard Andrews 1978 303 p
Avail: Univ. Microfilms Order No. 7905813

The electronic structure of the ground and two lowest excited states of deca-2,4,6,8-tetraene and dodeca-2,4,6,8,10-pentaene were investigated by infrared, Raman, high resolution absorption and fluorescence in mixed crystals at 4.2K, laser induced fluorescence and nanosecond fluorescence. Decatetraene showed a vibronically induced transition with the inducing mode being 103/cm in the ground state and 72/cm in the excited state. Cholesta-4,6,8(14)-triene(I) and cholesta-5,7,9(II)-triene-3Beta-ol(2) were investigated by low resolution absorption and fluorescence and by nanosecond fluorescence spectroscopy. Molecule 1 was found to have a large energy separation between the absorption and emission spectra and a radiative lifetime of 13 nsec. Molecule 2 had mirror-image symmetry for the absorption and emission spectra overlapping origin of absorption and emission, and a radiative lifetime of 2.8 nsec. Dissert. Abstr.

N79-19092 Johns Hopkins Univ., Baltimore, Md.
THE OXIDATION OF CARBON MONOXIDE OVER SUPPORTED PALLADIUM CATALYSTS Ph.D. Thesis
William Brown 1978 373 p
Avail: Univ. Microfilms Order No. 7906434

The kinetics of the carbon monoxide oxidation reaction were investigated in the temperature range 110-180 C. Supported palladium catalysts of varied metal loading, dispersions,

and preparations were utilized. Strong inhibition by CO was observed over the entire range of temperature and pressure studied. Derived coverages reinforce the contention that CO adsorption was very strong and severely limited the amount of oxygen adsorption. The data could be adequately fitted to a simple Langmuir-Hinshelwood model and was consistent with oxygen adsorption being rate-limiting. Values determined for the apparent activation energy ranged from 13.6-19.1 Kcal./mole, somewhat lower than previously reported figures. Volumetric adsorption data indicated that CO tends to adsorb to a greater extent on Pd than does oxygen under the operating conditions.
Dissert. Abstr.

N79-19093 California Univ., Santa Cruz.
TRANSVIBRONIC EXCITATION OF RUBIDIUM ATOMS IN CROSSED MOLECULAR BEAMS WITH N2 AND CO2: AN EXPERIMENTAL STUDY IN ENERGY TRANSFER Ph.D. Thesis
Richard Ernest Demaray 1978 212 p
Avail: Univ. Microfilms Order No. 7905665

A high resolution crossed molecular beam apparatus was employed in which the Boltzman fraction of diatoms in the first vibrational excited state could varied independently of the relative translational motion. The excitation function was found to scale with the Boltzman fraction of diatoms in the v = 1 vibrational state for translational energy. The relative efficiency of the first quantum of vibrational energy was found to be equal to the equivalent translational energy in promoting Rb excitation by N2. In the case of CO, the vibrational quantum was found to be an order of magnitude more effiecient than the equivalent translational energy. This was explained in terms of the Bauer, Fisher, Gilmore optical model for collisional excitation. The apparent disagreement of earlier excitation studies with well known electronic quenching results was explained by relative cross sections for the individual vibrational states. Dissert. Abstr.

N79-19094 California Inst. of Tech., Pasadena.
SOLID STATE NMR STUDIES OF METAL HYDRIDES Ph.D. Thesis
Ann Tryon Nicol 1979 152 p
Avail: Univ. Microfilms Order No. 7904853

Both conventional and multiple pulse NMR studies of the compounds H2O3(CO)10, H4Ru4(CO)12 and H4OS4(CO)12 as well as multiple pulse studies of CaH2,SrH2, and BaH2 are reported. Chemical shift tensors for protons directly bonded to heavy metal atoms in the metal carbonyl compounds have an isotropic value close to that observed in solution and an anisotropy of less than 30 ppm. The temperature dependent spectra of H4Ru4(CO)12 indicates the presence of anisotropic proton reorientation at room temperature. The mean standard deviation of the isotropic proton chemical shift for the ionic solids CaH2, SrH2, and BaH2 was in the range of 0 to 10 ppm, and a trend in the isotropic value of shift toward higher field as a function of cation electronegativity is noted. Structured proton NMR lineshapes, are reported for the metal cluster carbonyl compounds. Dissert. Abstr.

N79-19095 Maryland Univ., College Park.
THE APPLICATION OF LASER ENHANCED IONIZATION TO ANALYTICAL FLAME SPECTROMETRY Ph.D. Thesis
Gregory Chester Turk . 1978 151 p
Avail: Univ. Microfilms Order No. 7906649

Laser enhanced ionization is a new flame spectrometric technique which was developed for the analysis of trace elements. As the name implies, the method is based on the enhanced degree of thermal ionization of the analyte element in the flame resulting from intense photoexcitation of the analyte achieved by using a tunable dye laser. Signal detection is accomplished by measuring the electrical conductivity of the flame via an electrode probe system. The nonoptical nature of the signal detection makes laser enhanced ionization unique among the various flame spectrometric techniques. Problems associated with optical detection, such as scattered or stray light, are avoided. The method does possess many similarities to flame atomic absorption, emission, and fluorscence, but has many aspects which are unique. Dissert. Abstr.

N79-19096 California Inst. of Tech., Pasadena.
THE CHEMISORPTION OF CARBON MONOXIDE, OXYGEN AND NITRIC ACID ON THE RUTHENIUM (001) SURFACE Ph.D. Thesis
Glenn Ellwood Thomas 1979 144 p
Avail: Univ. Microfilms Order No. 7904855

The vibrational energies of small molecules adsorbed on the Ru(001) surface were studied by means of inelastic electron scattering. The instrument used to carry out this work was an electron spectrometer of the Kuyatt-Simpson type. The design and operation of this instrument, which was capable of carrying out a number of electron spectroscopies important in chemisorption research, is discussed. The vibrations of carbon monoxide, oxygen and nitric oxide chemisorbed on the basal plane of Ru provided insight into their chemical structures. Carbon monoxide exhibited the carbon-oxygen stretching frequency characteristic of a linear CO, with a single carbon-metal bond. This was true at all coverages, although at saturation coverage the low-energy electron diffraction pattern showed that the adsorbed CO overlayer was out of registry with the substrate. Dissert. Abstr.

N79-19097 Purdue Univ., Lafayette, Ind.
CHARACTERIZATION OF VOLTAMMETRIC ELECTRODE PROCESSES BY PATTERN RECOGNITION TECHNIQUES Ph.D. Thesis
Richard Arthur DePalma 1978 183 p
Avail: Univ. Microfilms Order No. 7905713

On-line pattern recognition techniques were used to determine the peak multiplicity of real voltammograms, and to predict the heterogenous kinetic parameters of electroreductions from voltammetric curve shape. For the peak multiplicity determination, the voltammogram was represented by its Fourier transform, and the k-Nearest-Neighbor method was used for classification. The training set consisted of a composite of theoretical and real data. The accuracy of this classification procedure was demonstrated with seven single systems and one doublet system at two overlap conditions and four peak height ratios. These systems included: Fe(3+), In(3+), Pb(2+), Tl(+), Cd(2+), Eu(3+), Co(2+) singlets and Pb(2+)/Tl(+) doublets. The training which was developed for this classification procedure was able to correctly classify real voltammograms which were previously unseen.
Dissert. Abstr.

N79-19098 Purdue Univ., Lafayette, Ind.
THE APPLICATION OF MASS-ANALYZED ION KINETIC ENERGY SPECTROMETRY TO THE CHARACTERIZATION OF INDIVIDUAL COMPONENTS OF COMPLEX MIXTURES Ph.D. Thesis
Richard Walter Kondrat 1978 187 p
Avail: Univ. Microfilms Order No. 7905739

The utility of mass spectrometry in mixture analyses has progressed rapidly but was limited by the necessity to treat the sample prior to analysis in order to reduce the complexity of the mass spectra obtained for mixtures. An alternative mass spectrometric method, using mass-analyzed ion kinetic energy spectrometry (MIKES) for the analysis of individual components in complex, untreated mixtures is presented. The hallmark of this method is the ability to perform analyses without prior sample treatment, thus allowing a significant reduction in total analysis time. Analysis is accomplished by the sequence: chemical ionization of the sample, separation of individual ions according to their mass-to-charge ratio via a magnetic sector, production of fragment ions from the mass-selected ion beam in a high energy ion/molecule reaction, and kinetic energy analysis of the fragment ions. Dissert. Abstr.

N79-19099 Northeastern Univ., Boston, Mass.
MATRIX INTERFERENCES IN FURNACE ATOMIC ABSORPTION SPECTROMETRY Ph.D. Thesis
Joseph Anthony Krasowski 1978 82 p
Avail: Univ. Microfilms Order No. 7904162

Graphite furnace atomizers have extended the sensitivity and detection limits for atomic absorption analysis by two to three orders of magnitude. The matrix interferences that may be encountered in the use of this technique are discussed, as a function of atomizer design and matrix composition. A conventional graphite atomizer which used either a cup or tube type atomizer was compared with a long path length, constant temperature

furnace. A background corrected absorbance (BCA) system was built to assure accuracy in the constant temperature furnace analyses, and the conventional atomizer was used with a spectrometer that has a BCA readout. Physical and chemical effects were examined by varying the metal analyte and matrix composition and volatility and by varying the concentration of the analyte in the part per billion range and the matrix in the part per million to part per thousand range. Dissert. Abstr.

N79-19100 Stanford Univ., Calif.
NEW METHODS IN LASER SPECTROSCOPY Ph.D. Thesis
Frank Victor Kowalski 1978 79 p
Avail: Univ. Microfilms Order No. 7905891

A wavemeter capable of measuring the absolute wavelength of cw laser radiation to one part in 10 to the 8th power is described. It consisted of a two-beam interferometer in which fringes, from a standard and unknown laser, were counted simultaneously as one arm of the interferometer was moved. The standard and unknown beams traveled identical paths in opposite directions. Therefore, any vibrations of the interferometer effected both fringe patterns equally. The laser beams emerged at separate detectors so that there was no need for a dichroic beam splitter to separate them and measurements can be made close to the wavelength of the standard if desired. Moreover, the visible spots of light on the mirrors can be brought into coincidence, ensuring that the two path lengths were nearly indentical. The possibilities of data processing that would employ the same wavemeter to measure pulsed laser sources are also discussed. Dissert. Abstr.

N79-19101 Stanford Univ., Calif.
POLARIZATION LABELING SPECTROSCOPY OF MOLECULES Ph.D. Thesis
Richard Earl Teets 1978 141 p
Avail: Univ. Microfilms Order No. 7905936

A new method of molecular spectroscopy, called polarization labeling spectroscopy, was developed to study molecules in a specific rotational-vibrational ground state level, without interference from molecules in nearby levels. A polarized pump laser is used to orient molecules in a specific level by optical pumping. This effectively labels these molecules, and they can be sensitively detected by their effect on the polarization of a probe laser. By probing with a very broad band laser, a large portion of the absorption spectrum of the labeled state can be recorded. This spectrum gives direct information about the spacings of the excited state levels, which are difficult to determine by conventional methods. Dissert. Abstr.

N79-19102 Minnesota Univ., Minneapolis.
RHEOLOGY CHANGES DURING NETWORK FORMATION BY END LINKING OF POLYDIMETHYLSILOXANE Ph.D. Thesis
Enrique Marcelo Valles 1978 118 p
Avail: Univ. Microfilms Order No. 7906386

Relations between structure and properties of a model polydimethylsiloxane system were studied in the pregel and postgel region. The network was obtained by crosslinking long polydimethylsiloxane molecules with vinyl groups at their ends with crosslinks of functionalities three and four. In the pregel region the viscosity rise during polymerization was followed with a cone and plate rheometer and the extent of reaction by infrared. From the extent of reaction the weight average molecular weight and the average weight of the longest chain in the branched structure were calculated. These two molecular parameters, together with the ones used to correlate the results in the postgel region, were derived making use of a recursive method. Dissert. Abstr.

N79-19103 Northwestern Univ., Evanston, Ill.
A STUDY OF RADIANT ENERGY DISTRIBUTIONS IN PHOTOCHEMICAL REACTORS AND THE PHOTOCHLORINATION OF TRICHLOROETHYLENE IN A STIRRED VESSEL Ph.D. Thesis
Thomas Joseph Gebhard 1978 294 p
Avail: Univ. Microfilms Order No. 7903266

The radiation profiles for a finite length of a cylindrical low pressure mercury lamp and a black light fluorescent lamp of the same size were measured, using an accurately positioned flat selenium photocell. The mercury lamp was modeled as a finite volumetric region characterized by isotropic radiation and a constant self-absorption coefficient. The fluorescent lamp was modeled as a finite surface source of radiation with an experimentally determined emission factor which indicated that the lamp was neither isotropic nor perfectly diffuse. The effects of reflection and refraction on the radiant energy distribution in a nonabsorbing annual reaction medium were closely predicted, using a model which incorporated geometrical optics techniques and a relative area approach to establish the radiant flux in the reaction medium. Dissert. Abstr.

N79-19104 Northwestern Univ., Evanston, Ill.
P-V-T-MEASUREMENTS FOR ETHYL ALCOHOL, N-HEXANE AND THEIR BINARY MIXTURES IN THE SUPERCRITICAL REGION Ph.D. Thesis
Narendra Gangoli 1978 184 p
Avail: Univ. Microfilms Order No. 7903262

A constant volume P-V-T facility was constructed and was capable of withstanding temperatures up to 400 C and pressures up to 69,000 kPa (approximately 10,000 psi). The fluid under investigation was confined in a thick walled bomb vessel of approximately 300 cc capacity. The temperatures were measured by means of calibrated chromel alumel thermocouples. The pressures were measured by means of a differential pressure indicator cell, using nitrogen as the balancing medium. The pressure of the nitrogen gas was measured by a dead weight gauge. A total of eight constant mass runs was conducted for ethyl alcohol at temperatures ranging from 225 to 335 C and at pressures up to 67,000 kPa. From these experimental data, compressibility factors at convenient intervals of T sub R and P sub R were calculated and presented in a tabular form. A comparison with the literature data for the experimental region of this study produced a maximum deviation of 2 percent. Dissert. Abstr.

N79-19105 Wisconsin Univ. - Madison.
TWO-LIQUID-PHASE REACTIONS OF MOLECULAR OXYGEN. 1: COPPER CATALYZED ASCORBIC ACID AUTOXIDATION. 2: AN IODOHYDRIN ROUTE TO EPOXIDES Ph.D. Thesis
Robert Stephen Davidson 1978 192 p
Avail: Univ. Microfilms Order No. 7820617

Reactions of molecular oxygen constitute an important class of industrial processes. These are often carried out more economically in the liquid than in the gas phase. Two specific reaction schemes were investigated. Copper-ion catalyzed ascorbic acid autoxidation was studied, focusing on the effect of gas-liquid mass transfer on apparent kinetics. A mathematical model of simultaneous mass transfer and chemical reaction showed that interaction between the two processes can lead to observed kinetics that are much different from true reaction behavior. Not only reaction rate, but also apparent reaction order with respect to species concentration can vary with changes in initial conditions. Application of this model to ascorbic acid autoxidation showed that coupling of oxygen transfer with bulk reaction affects the reaction rate and apparent order with respect to oxygen, ascorbic acid, copper ion, and hydrogen ion concentrations.Dissert. Abstr.

N79-19106 Lehigh Univ., Bethleham, Pa.
THE ROLE OF MIXED EMULSIFIER SYSTEMS IN THE PREPARATION OF EMULSIONS AND LATEXES Ph.D. Thesis
Yungnien John Chou 1978 231 p
Avail: Univ. Microfilms Order No. 7904300

Mixed emulsifiers, ionic surfactants and fatty alcohols, were widely used in the preparation of stable emulsions and latexes in comparison to similar amounts of ionic emulsifier alone. The mechanism for emulsification is of great interest to study. The direct investigation is difficult if not impossible. Therefore, information concerning the mechanism of emulsification using the ionic emulsifier-cetyl alcohol and other long-chain alcohol mixtures was obtained through various indirect investigations. The conductometric titration information obtained by titrating the oil phase into the aqueous single and the mixed emulsifier systems show different conductometric titration curves. This implies a completely different emulsification process for the two systems. In comparison, the titration in aqueous hexadecyltrimethylam-

monium bromide solution gave a decrease (solubilization) to an inflection point, followed by a slower decrease (emulsification). Dissert. Abstr.

N79-19107 Pennsylvania State Univ., University Park.
INVESTIGATION OF THE COMBUSTION REGION OF FIRE-INDUCED PLUMES ALONG UPRIGHT SURFACES Ph.D. Thesis
Tanvir Ahmad 1978 224 p
Avail: Univ. Microfilms Order No. 7902569

The heat transfer characteristics and structure of laminar and turbulent fire-induced plumes along upright surfaces were considered. The active pyrolysis zone located at the base of a wall, as well as the combusting and noncombusting portions of the wall plume generated by the fire, were studied. In the case of laminar fire plume, a numerical solution of the boundary layer equations was formulated for an upright burning surface under natural convection conditions. The wall heat flux and the flame shapes were measured for laminar wall fires using a variety of liquid fuels. Predicted wall heat fluxes and flame shapes were in reasonable agreement with the measurements. In the case of the turbulent fire plume, more emphasis was given to the experimental results. Measurements were made of the burning rates, radiative and convective heat fluxes to the wall, and profiles of mean velocities, temperatures and concentrations. Dissert. Abstr.

N79-19108 Pittsburgh Univ., Pa.
THE RECOVERABLE COMPLIANCE OF A SERIES OF BIMODAL POLYSTYRENE BLENDS, AND THE NUMERICAL DETERMINATION OF RETARDATION SPECTRA Ph.D. Thesis
Stephen John Orbon 1978 214 p
Avail: Univ. Microfilms Order No. 7902741

The recoverable compliances of a series of blends of two polystyrene fractions were measured. One of the fractions had a molecular weight less than M sub c, one greater. The recovery data was analyzed using a computer program written to numerically invert the integral equation describing recovery to yield the retardation spectrum. Techniques were developed to eliminate the effects of errors in the data on the inversion algorithm. Subroutines were incorporated into the computer program which perform the calculation of other viscoelastic functions from the retardation spectrum, and the viscosity. Examination of the retardation spectra of the blends suggests that the recovery can be interpreted on the basis of the behavior of the individual components. An interaction between the two components was not detected. Dissert. Abstr.

N79-19109 Oklahoma State Univ., Stillwater.
LIQUID DENSITY BEHAVIOR IN THE CRITICAL REGION Ph.D. Thesis
Larry Lee Lilly 1978 92 p
Avail: Univ. Microfilms Order No. 7903701

Two different techniques for the determination of liquid mixture densities were used to measure liquid densities in the critical region. These two systems were employed to measure the liquid density of the pure components propylene, methanol and octane and the binaries methane-propane and ethylene-propylene. Both techniques were found to produce reliable experimental densities. Liquid densities for the pure components in the critical region were measured with a calculated error of 1.5 per cent. Liquid densities for the two mixtures in the critical region were measured with a calculated error of as much as 5 per cent. Several recommendations for improvement of procedure and improvement of design were determined. Dissert. Abstr.

N79-19110 Pennsylvania State Univ., University Park.
THERMOCHEMISTRY AND KINETICS OF OXYGEN INTERACTION WITH MICROPOROUS CHIPS Ph.D. Thesis
Ismail Mahmoud Kamal Ismail 1978 212 p
Avail: Univ. Microfilms Order No. 7902612

Differential scanning calorimetry and thermogravimetric analysis were used to study the exothermicity and kinetics of interaction between Saran chars and oxygen at selected isothermal temperatures in the range 75-850 C. Three major Saran chars, particle size (150 x 250 mesh), were used. The samples were characterized by determining: active surface areas, total surface areas, and mercury densities. Author

N79-19111 Engineering Sciences Data Unit, London (England).
THERMAL CONDUCTIVITY OF LIQUID GLYCOLS GLYCEROL AND THEIR AQUEOUS SOLUTIONS
Oct. 1978 15 p
(ESDU-78033; ISBN-0-85679-237-3) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springield, Va. 22161

Values of thermal conductivity at saturation pressure are presented in tabular form, for the liquid polyhydric alcohols and their aqueous solutions. The data on which these recommended values of thermal careductivity are based on the most reliable available and the range covered is from the melting point to approximately 0.9 of the critical temperature. ESDU

N79-19112*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF FIRE TEST METHODS FOR AIRPLANE INTERIOR MATERIALS Final Report
Everett A. Tustin Oct. 1978 301 p refs
(Contract NAS9-15168)
(NASA-CR-160119; D6-48071) Avail: NTIS HC A14/MF A01 CSCL 21B

Fire tests were conducted in a 737 airplane fuselage at NASA-JSC to characterize jet fuel fires in open steel pans (simulating post-crash fire sources and a ruptured airplane fuselage) and to characterize fires in some common combustibles (simulating in-flight fire sources). Design post-crash and in-flight fire source selections were based on these data. Large panels of airplane interior materials were exposed to closely-controlled large scale heating simulations of the two design fire sources in a Boeing fire test facility utilizing a surplused 707 fuselage section. Small samples of the same airplane materials were tested by several laboratory fire test methods. Large scale and laboratory scale data were examined for correlative factors. Published data for dangerous hazard levels in a fire environment were used as the basis for developing a method to select the most desirable material where trade-offs in heat, smoke and gaseous toxicant evolution must be considered. Author

N79-19113*# California Univ., San Diego, La Jolla. Inst. for Pure and Applied Physical Science.
CHEMICAL VAPOR DEPOSITION OF HIGH T SUB c SUPERCONDUCTORS Final Report, 1 May 1975 - 31 Dec. 1978
G. W. Webb and John J. Engelhardt 31 Dec. 1978 60 p refs
(Grant NsG-3055)
(NASA-CR-158241) Avail: NTIS HC A04/MF A01 CSCL 07D

The results are reported of an investigation into the synthesis and properties of high temperature superconducting materials. A chemical vapor deposition apparatus was designed and built which is suitable for the preparation of multicomponent metal films This apparatus was used to prepare a series of high T sub c A-15 structure superconducting films in the binary system Nb-Ge. The effect on T sub c of a variety of substrate materials was investigated. An extensive series of ternary alloys were also prepared. Conditions allowing the brittle high T sub c (approximately 18 K) A-15 structure superconductor Nb3A1 to be prepared in a low T sub c but ductile form were found. Some of the ways that the ductile (bcc) form can be cold worked or machined are described. Measurements of rate of transformation of cold worked bcc material to the high T sub c A-15 structure with low temperature annealing are given. Preliminary measurements indicate that this material has attractive high field critical current densities. L.S.

N79-19114*# National Aeronautics and Space Administration, Washington, D. C.
DETERMINATION OF VIBRATION-ROTATION LINES INTENSITIES FROM ABSORPTION FOURIER SPECTRA
J. Y. Mandin Mar. 1979 18 p refs Transl. into ENGLISH from J. Optics (Paris) v. 9, no. 5 p 311-316 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75428) Avail: NTIS HC A02/MF A01 CSCL 07D

The method presented allows the line intensities to be calculated from either their equivalent widths, heights, or quantities deduced from spectra obtained by Fourier spectrometry. This

method has proven its effectiveness in measuring intensities of 60 lines of the molecule H2O with a precision of 10%. However, this method cannot be applied to isolated lines. L.P.

N79-19115# Rutgers - The State Univ., Piscataway, N. J.
X-RAY HIGH PRESSURE STUDY OF POLYVINYLIDENE FLUORIDE
B. A. Newman, C. H. Yoon, and K. D. Pae 20 Nov. 1978 27 p refs
(Contract N00014-75-C-0540)
(AD-A062017; TR-13) Avail: NTIS HC A03/MF A01 CSCL 11/9

An X-ray high pressure study at room temperature of both phase 1 and phase 2 crystal structures of polyvinylidene fluoride has been carried out. At room temperature both phases are stable up to pressures greater than 14 kbars. The variation of lattice compressive strains with pressure could be fitted to the Tait equation with little scatter and the variation of the unit cell parameters with pressure computed. The bulk lattice compressibilities of both phase 1 and phase 2 was found to be considerably less than that of polyethylene with the lowest compressibility being found for the phase 1 structure. GRA

N79-19116# Exxon Research and Engineering Co., Linden, N. J. Government Research Lab.
RADIATION AUGMENTED COMBUSTION Annual Report, 1 Jun. 1977 - 31 May 1978
Anthony E. Cerkanowicz and William Bartor Jul. 1978 87 p refs
(Contract F49620-77-C-0085)
(AD-A062035; EXXON/GRUS.1BFB-78; AFOSR-78-1508TR) Avail: NTIS HC A05/MF A01 CSCL 21/2

Radiative initiation and enhancement of combustion in unsensitized fuel-air mixtures via the photodissociation of oxygen molecules and combustion intermediary species is being investigated. Pulsed VUV (vacuum ultraviolet) light sources and continuous UV (ultraviolet) light sources are being used for this purpose. Experimental efforts are directed at elucidation of light source conversion efficiency and spectral characteristics, and reactant mixture-photon interactions. A complimentary effort involves the development of analytical capability required for modeling photochemical initiation and enhancement of combustion. Author (GRA)

N79-19117# Tennessee Univ., Knoxville.
CHARACTERIZATION AND CONTINUOUS EXTRUSION OF ISOTROPIC AND ANISTROPIC POLY (pHENYLENE TEREPHTHALAMIDE)/SULFURIC ACID SOLUTIONS TO FORM RIBBONS AND BLOWN FILM Technical Report, 1 Apr. 1977 - 25 Sep. 1978
Hiroshi Aoki, Yoshihik Onogi, James L. White, and John F. Fellers 10 Nov. 1978 42 p refs
(Contract N00014-77-C-0236)
(AD-A061783; PSE-124) Avail: NTIS HC A03/MF A01 CSCL 07/4

An experimental characterization and processing study of redissolved Kevlar and poly(p-phenylene terephthalamide)/sulfuric acid solutions is reported. Polarized light microscopy studies show the development of an anisotropic phase. When two phases coexist, negatively birefringent spherulites are observed. At higher concentrations, a single phase of coalescing spherulites is seen and following melting and subsequent cooling, nematic (threadlike) structures are observed. Viscosity and normal stresses were measured at various concentrations and temperatures. A yield stress is exhibited at room temperature. Both room temperature and 60 C viscosity versus concentration curves display maxima. The solutions in concentration range from 2 to 12% have been extruded as ribbons and as annular blown tubular film. Processing variables and problems are discussed. Wide angle X-ray scattering patterns of films show orientation. Tensile properties have been measured on films. Author (GRA)

N79-19118# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
BASIC INSTABILITY MECHANISMS IN CHEMICALLY REACTING SUBSONIC AND SUPERSONIC FLOWS Final Report, Oct. 1973 - Sep. 1978
Tau-Yi Toong Nov. 1978 25 p refs
(Grant AF-AFOSR-2619-74)
(AD-A061976; AFOSR-78-1502TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

This report summarizes the main results and conclusions obtained in a research program on basic instability mechanisms in chemically reacting flows. Both theoretical and experimental work was conducted to determine the linear and the non-linear coupling between chemical kinetics and gas dynamics, which lead to wave interactions necessary for sustaining the instabilities. Acoustic, chemical and mixed modes of instability were identified. Non-linear wave-kinetic coupling was found to be important at high activation energies for weak shocks. Threshold values of shock strength and pulse width are required to initiate detonations or explosions. Author (GRA)

N79-19119# Air Force Academy, Colo.
XENON DIFLUORIDE FLUORINATION. MECHANISM AND SELECTIVITY OF BORON TRIFLORIDE ETHERATE CATALYSIS IN THE NORBORNENE MODEL Technical Report, 18 Aug. 1975 - 15 Jan. 1978
Scott A. Shackelford Aug. 1978 50 p refs
(AD-A061909; FJSRL-TR-78-0008) Avail: NTIS HC A03/MF A01 CSCL 07/3

The boron trifluoride etherate initiated fluorination of norbornene with xenon difluoride in dichloromethane solvent selectively produces the novel 2-exo-5-exo-difluoronorbornane and its analogous 2-endo 5-exo-difluoronorbornane represent approximately half the directly fluorinated reaction products, and the well-known anti- and syn-2,7-difluoronorbornane isomers comprise the remainder. Subsequently, the boron trifluoride etherate catalyzes selective isomerization of both 2,7-difluoronorbornanes to produce a nearly exclusive yield of the 2-exo-5-exo- and 2-endo-5-exo-difluoronorbornane isomers. A change to diethyl ether solvent yields the normal anti- and syn-2,7-difluoronorbornane isomers as the major difluoride products and quenches the boron trifluoride etherate isomerization. Substitution of lithim tetrafluoroborate for the boron trifluoride etherate in diethyl ether solvent again provides the unique 2,5-difluoronorbornanes as the major difluoride products. The 2,5-difluoronorbornane isomers were unambiguously identified by the direct fluorination of deuterated norbornene. The deuterated norbornene also permitted the initial fluorination mechanism and the selective isomerization pathway in dichloromethane solvent to be studied. Author (GRA)

N79-19120# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
PHOTOACTIVATION OF CLUSTER CATALYSIS: A COMPARISON OF 1-PENTENE ISOMERIZATION BY TETRACARBONYL TRIPHENYLPHOSPHINE RUTHENIUM AND 1,1,1,2,2,2,3,3,3,-NONACARBONYL1,-2,3-TRIS (TRIPHENYLPHOSPHINE)-TRIANGULO-TRIRUTHENIUM
James L. Graff, Robert D. Sanner, and Mark S. Wrighton 29 Nov. 1978 14 p
(Contract N00014-75-C-0880)
(AD-A061871; TR-12) Avail: NTIS HC A02/MF A01 CSCL 07/5

The photocatalyzed isomerization of 1-pentene to trans- and cis-2-pentene by Ru(CO)4PPh3 and Ru3(CO)9(PPh3)3 is reported along with data for Ru3(CO)12, Fe3(CO)12, and Fe(CO)5. The primary photoprocess in Ru(CO)4PPh3 is dissociative loss of CO giving a coordinatively unsaturated species having the same empirical formula Ru3(CO)9(PPh3)3; the trinuclear species undergoes Ru-Ru bond rupture and ultimate declusterification subsequent to photo-excitation giving a quantitative yield of Ru(CO)4PPh3 under CO or Ru(CO)3(PPh3)2 in the presence of PPh3. The crucial result is that the cluster yields a different catalytically active species compared to Ru(CO)4PPh3, since the initial ratio of trans- and cis-2-pentene is different for the two photocatalysts. The photocatalysis and primary photoprocesses suggest that the isomerization from the Ru3(CO)9(PPh3)3 results from an active form of the cluster. By way of contrast, Fe(CO)5 and Fe3(CO)12 yields the same initial ratio of photocatalytic products, implicating a common, mononuclear catalytic species. Since the clusters are good visible absorbers compared to the mononuclear species, photoactivation of cluster catalysis can be effected with low energy visible light. GRA

N79-19121# Texas Univ. at Austin.
CHEMICAL REACTIONS IN SHOCK WAVES Final Report, 15 Oct. 1974 - 31 May 1978
W. C. Gardiner, Jr. Oct. 1978 8 p refs
(Grant DAHC04-75-G-0061)
(AD-A061872; ARO-12637.3-C) Avail: NTIS HC A02/MF A01 CSCL 21/2

Experimental and computer modeling studies were carried out on chemical reactions at high temperatures, in particular on reactions which participate in combustion processes. Reaction initiation was by shock-wave heating, and reaction progress was monitored by spectroscopic methods. Systems studied include CS2-O2, CH4-O2, CH4-Ar, C2H2-Ar, C2H4-Ar, and C2H6-Ar.
Author (GRA)

N79-19122# Naval Research Lab., Washington, D. C.
NEW AGENTS FOR THE EXTINGUISHMENT OF MAGNESIUM FIRES Final Report, Aug. 1976 - Sep. 1977
Kenneth D. Lawrence, Frederick W. Williams, and Richard G. Gann Apr. 1978 31 p refs
(MIPR-FY8952-76-65017)
(AD-A061664; NRL-6180-376-KDL-FWW-NJS; CEEDO-TR-78-19) Avail: NTIS HC A03/MF A01 CSCL 13/12

Ground glass powders (frits) have been evaluated as possible suppressants for magnesium fires. Conceptually, these would melt and form a glass coating on the surface of the burning metal, isolating it from the oxygen supply. Some frits containing oxides of magnesium and lithium reacted violently with the burning magnesium. However, several low melting frits proved to be good suppressants and were better than commercial suppressants.
Author (GRA)

N79-19123# Life Systems, Inc., Cleveland, Ohio.
EVALUATION OF A BREADBOARD ELECTROCHEMICAL TOC/COD ANALYZER Annual Report, 1 Sep. 1977 - 31 Oct. 1978
R. J. Davenport, T. A. Berger, and R. A. Wynveen Oct. 1978 63 p refs
(Contract DAMB17-76-C-6077; DA Proj. 3E7-62720-A-835) (AD-A062011; LSI-ER-310-4-2) Avail: NTIS HC A04/MF A01 CSCL 07/4

The Breadboard Electrochemical TOC/COD Analyzer was assembled, tested and evaluated. The Analyzer operates on the basis of UV-catalyzed oxidation of organic solutes by persulfate. The Breadboard Analyzer has demonstrated for the first time that this technique can be used to measure COD concentrations and that COD measurements can be made simultaneously with TOC measurements using only one analyzer. Operating conditions have been optimized and synthetic and real samples were analyzed. The results obtained with the Breadboard Analyzer agree closely with the results of standard methods. Particulates do not interfere in the analyses and samples ranging from tap water to raw sewage were successfully analyzed. The Breadboard Analyzer was designed using concepts and analysis techniques that lend themselves to accurate, automated operation in the field and in industrial process monitoring and control applications. Future developments are anticipated to lead to automated, unattended operation for at least 30 days. Results, conclusions and recommendations are included.
Author (GRA)

N79-19124# Duke Univ., Durham, N. C. Dept. of Chemistry.
THE THEORY OF CHEMICAL SHIFTS IN THE HARTREE-FOCK APPROACH
D. B. Chesnut and F. W. Whitehurst Jun. 1978 18 p refs
(Grant DAAG29-76-G-0267)
(AD-A061897; ARO-14116.4-CX) Avail: NTIS HC A02/MF A01 CSCL 20/10

The general theory of chemical shifts has been well known since the paper of Ramsey in 1950. With the development of improved methods for obtaining new Hartree-Fock wave functions interest has again been rekindled to theoretically determine the chemical shift tensor in this approximation. The purpose of this report is to present what is believed to be a thorough and, hopefully, clear derivation of the theoretical expressions in what appears to be the most transparent approach. Following a brief review of the pertinent Hamiltonian, the Hellmann-Feynmann theorem is used to establish the general shift expression. This is followed by a discussion of London's approach to the origin-gauge problem and perturbed Hartree-Fock theory in a variable basis set. Finally, the chemical shift equations are derived by employing London's approach.
Author (GRA)

N79-19125# Pennsylvania State Univ., University Park. Dept. of Chemistry.
THE PREPARATIONS OF (NP(P-OC6H4LI)2)3 BY METAL-HALOGEN EXCHANGE, AND ITS REACTIONS WITH ELECTROPHILES Interim Technical Report
T. L. Evans, T. J. Fuller, and H. R. Allcock 13 Nov. 1978 5 p refs
(Contract N00014-75-C-0685)
(AD-A061690; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07/3

The first example of a successful metal-halogen exchange reaction between n-butyllithium and a hexa(p-halogenophenoxy) cyclotriphosphazene is described. The hexalithio derivative was allowed to react with electrophiles to yield carboxylic acid, stannane, and phosphine-derivatives.
Author (GRA)

N79-19126# Connecticut Univ., Storrs. Inst. of Water Resources.
REMOVAL OF METALLIC IMPURITIES FROM WATER BY ELECTROCHEMICAL METHODS
Norbert D. Green Oct. 1978 16 p refs
(Contract DI-14-31-0001-5007)
(PB-288687/7; W79-01121; OWRT-A-063-CONN(2)) Avail: NTIS HC A02/MF A01 CSCL 02D

A new low method for removing metallic impurities, based on electrochemical techniques is described. Replacement reactions using static and fluidized active metal beds (aluminum, magnesium and zinc) were used to remove metallic impurities (such as Hg(+2), Cu(+2), Pb(+2), Ni(+2), Co(+2), Cr(+3)m Cr(+6) from water. The results show that in many cases, this approach offers a practical method for removing metallic impurities from water and wastewater streams.
GRA

N79-19127# Tennessee Valley Authority, Chattanooga. Office of Power.
CHARACTERIZATION OF SOLID RESIDUES FROM FLUIDIZED-BED COMBUSTION UNITS Final Report, Jul. 1975 - Jun. 1977
James L. Crowe and Stephen K. Seale Jul. 1978 48 p
(PB-288584/6; EPA-600/7-78-135; PRS-31) Avail: NTIS HC A03/MF A01 CSCL 07D

Physical and chemical characterizations of samples of spent bed material and of flyash from three experimental atmospheric and pressurized fluidized-bed combustion units were provided. It also gives results of characterization of samples of bed material which had been subjected to sorbent regeneration. In general, it was found that the granular material consisted of three shells or zones. The outer zone, primarily CaSO4, was 2-25 micrometers thick; an intermediate zone, CaSO4 and soft-burned CaO, was 60-150 micrometers thick; and the third zone, in the center of the particle (for samples with incomplete sulfation), was primarily original absorbent. Particle size analysis showed that, in general, CaSO4 and Ca(OH)2 concentration increased as the size of the particle decreased and that CaCO3 was more concentrated in the larger fraction.
GRA

N79-19128# Rhode Island Univ., Kingston.
BIO-REGENERATION OF HYDROCARBON-EXHAUSTED ACTIVATED CARBON Technical Completion Report, 1 Oct. 1976 - 20 Sep. 1978
1978 25 p refs
(Contract DI-14-31-0001-8432)
(PB-288651/3; W79-01093; OWRT-A-063-RI(1)) Avail: NTIS HC A02/MF A01 CSCL 07A

Activated carbon was exhausted with either glucose or hydrocarbon (nonane or decane) and regenerated biologically with Escherichia coli or Pseudomonas aeruginosa, respectively. Regeneration was carried out in aerated glass columns after the addition of a mineral medium to supply nutrients other than the carbon source adsorbed on the carbon. Glucose-exhausted carbon was restored to full adsorption capacity following growth of E. coli. It is suggested that increased surface area resulting from abrasion during regeneration and washing may have compensated

for any decreased adsorption capacity due to metabolic end-products and/or adhering cells. In contrast, the adsorption capacity of hydrocarbon-exhausted carbon regnerated by growth of P. P. aeruginosa was reduced approximately 66%. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-19129 Northwestern Univ., Evanston, Ill.
MAGNETIC IMPURITY STATES IN THE INTERMETALLIC COMPOUND BETA-NiAl Ph.D. Thesis
Yoshitaka Ochiai 1978 35 p
Avail: Univ. Microfilms Order No. 7903332

The resistivity measurements were made on (1) approximately 500 ppm Fe doped intermetallic compound beta prime - Ni(x)al(100-x) (x = 46.9 to 51.5 at.%), (2) beta prime - Ni48Al52 with 3d transition metal impurities and (3) the rapidly cooled specimens of the approximately 500 ppm Fe doped beta prime - Ni(x)Al(100-x) described above as (1). A description of each of the three kinds of specimens or treatments follows the above numerical listing. Dissert. Abstr.

N79-19130 California Univ., Berkeley.
FATIGUE CRACK INITIATION AND PROPAGATION IN STEELS EXPOSED TO INERT AND CORROSIVE ENVIRONMENTS Ph.D. Thesis
Kourosh Youssefi 1978 193 p
Avail: Univ. Microfilms Order No. 7904662

The fatigue crack initiation life of AISI 1018 steel was investigated using compact tension specimens having sharp notch root radii. Results showed that the number of cycles to initiate a crack from a notched component can be predicted quite accurately, and that the number of cycles required to initiate a fatigue crack is related to the stress intensity factor range, notch radius, and power law. Propagation was studied using AISI 1018 steel and a new high strength steel HY-180. It was observed that the crack propagation rate of the low yield strength 1018 steel was lower than that of HY-180 steel. At the test temperature of 185 F, the crack propagation rate of AISI 1018 steel decreased significantly compared to room temperature values. Observations also indicate using common generalization, crack propagation data for all steels fall in a narrow band.
Dissert. Abstr.

N79-19131 California Univ., Berkeley.
MICROSTRUCTURE AND MAGNETIC PROPERTIES OF SPINODAL Fe-Cr-Co ALLOYS Ph.D. Thesis
Masuo Okada 1978 168 p
Avail: Univ. Microfilms Order No. 7904565

The relationship between the microstructure and magnetic properties of spinodally decomposed Fe-Cr-Co ductile permanent magnet alloys was investigated using transmission electron microscopy, electron diffraction, Lorentz microscopy, and magnetic analysis. Isothermal aging of three alloys (Fe-16 wt% Cr-28 wt% Co, Fe-31 wt% Cr-23 wt% Co, Cr-26 wt% Fe-13 wt% Co) located along the same conjugate tie-line inside a miscibility gap resulted in decomposition into two phases, and Fe-Co rich phase alpha 1 and a Cr-rich phase alpha 2. The microstructural features of the decomposed products were consistent with those expected from a spinodal reaction and agree with the asymmetry in shape of the reported miscibility gap in the Fe-Cr-Co system. An Fe-31 wt% Cr-23 wt% Co alloy was found to be best among the three alloys as a permanent magnet because of its excellent combination of good ductility and good magnetic properties.
Dissert. Abstr.

N79-19132 Purdue Univ., Lafayette, Ind.
ELECTRO-DISCHARGE MACHINING: THE INFLUENCE OF THE RECAST LAYER AND THE HEAT AFFECTED ZONE ON FATIGUE STRENGTH Ph.D. Thesis
Mostafa R. Reda 1976 227 p
Avail: Univ. Microfilms Order No. 7905684

The effect of EDM and layer removal on the fatigue life of 18 percent nickel maraging steel for normal and roughing cutting conditions was investigated. A thermal conduction model, which predicts the isothermal lines below the surface of an EDM'd component, was modified and used to predict the thickness of the recast layer and the altered metal zone. The predicted values of the melting boundary were compared with experimental results by measuring the thickness of the recast layer. The results show that from 50 to 60 percent of the molten metal remains on the surface to become the recast layer. A fracturing technique was used to observe and measure the recast layer. It was evaluated and verified by comparison with the metallurgical changes that occur at the melting boundary. Fatigue life tests were performed on samples of 18 percent nickel maraging steel, machined to ASTM standards. Dissert. Abstr.

N79-19133 California Univ., Berkeley.
A STUDY OF THE ELECTROWINNING OF METALS USING A FLUIDIZED BED ELECTRODE Ph.D. Thesis
Bruce James Sabacky 1978 108 p
Avail: Univ. Microfilms Order No. 7904592

A three-part study was performed in order to analyze the behavior of the fluidized bed electrode and evaluate its possible application to the electrowinning of metals. Calculations made using mathematical models revealed that the effective electrical resistivity of the particulate matrix is of major importance in the design and operation of a fluidized bed electrode, and that a sufficiently high voltage must be applied in order to cathodically protect the relatively inactive regions of the electrode when oxidizing agents are present in the electrolyte. The experimental measurement of the fluidized bed electrode resistivity pointed to marked dependence of parameter on bed expansion and relative independence of particle size, electrolyte composition, and the frequency of alternating current used in measurement. Deposition experiments demonstrated that high rates of metal deposition can be achieved in a relatively small reactor volume.
Dissert. Abstr.

N79-19134 California Univ., Berkeley.
ROLE OF QUATERNARY ADDITIONS ON DISLOCATED MARTENSITE, RETAINED AUSTENITE AND MECHANICAL PROPERTIES OF Fe/Cr/C STRUCTURAL STEEL Ph.D. Thesis
1978 188 p
Avail: Univ. Microfilms Order No. 7904558

The influence of quaternary alloy additions of Mn and Ni to Fe/Cr/C steels which were designed to provide superior mechanical properties was investigated. Transmission electron microscopy and X-ray analysis revealed increasing amounts of retained austenite with Mn up to 2 w/o and with 5 w/o Ni additions after quenching form 1100 C. This was accompanied by a corresponding improvement in toughness properties of the quaternary alloys. In addition, the generally attractive combinations of strength and toughness in these quaternary alloys was attributed to the production of dislocated lath martensite from a homogeneous austenite phase free from undissolved alloy carbides. Grain-refining resulted in a further increase in the amount of retained austenite. Dissert. Abstr.

N79-19135 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE EFFECT OF HYDROGEN ON THE FATIGUE LIFE OF HIGH STRENGTH STEEL Ph.D. Thesis
James Harris Wilson 1978 162 p
Avail: Univ. Microfilms Order No. 7903206

Torsional fatigue tests were conducted on 4370 steel oil quenched and tempered at 1000 F in (1) the uncharged state, (2) the hydrogen charged state, and (3) in a hydrogen environment. The tests were conducted on both smooth and V notch test specimens. A statistical analysis conducted at the 99% confidence limit for the smooth test specimens indicated that precharging with hydrogen increased the fatigue life of the material and also the fracture surface of the test specimens changed from a circumferential crack to a 45 degree diagonal crack. At a 90% confidence limit, charging with hydrogen did not affect the fatigue life of the V-notched specimens. At a 99% confidence limit for both the smooth and V-notched test specimens, testing in a hydrogen environment increased the fatigue life of the material. Bending fatigue tests were also conducted on the same material. Dissert. Abstr.

N79-19136 Rensselaer Polytechnic Inst., Troy, N. Y.
CORROSION FATIGUE OF ALUMINUM ALLOY 7075 Ph.D. Thesis
Richard Joseph Jacko 1978 400 p
Avail: Univ. Microfilms Order No. 7903214

The corrosion fatigue behavior of aluminum 7075 was studied in dry air, distilled water, and solutions of NACl, Na2SO4, and H2SO4 under free corrosion conditions and under applied polarization. Anion concentration and bulk solution pH also were varied. Results indicate that all aqueous solutions appreciably lower fatigue resistance. The Cl(-) ion generally produces the greatest reduction in fatigue resistance while the SO4(=) ion behaves essentially in the same manner as distilled water. Results indicate that both adjusting bulk solution pH and increasing the anion concentration can accelerate fatigue cracking. The magnitude of these effects is a direct function of the electrochemical conditions and the resultant oxide film integrity at the crack tip. It is suggested that corrosion fatigue of 7075 aluminum is essentially a hydrogen embrittlement phenomenon.
Dissert.Abstr.

N79-19137 Pittsburgh Univ., Pa.
SOLIDIFICATION AND CREEP BEHAVIOR AT 0.5 T SUB E - 0.6 T SUB E OF Nb-N B-2C IN SITU COMPOSITES Ph.D. Thesis
Kuang Yang Lin 1978 158 p
Avail: Univ. Microfilms Order No. 7902739

The high temperature creep behavior of Nb-Nb2C in situ composites with various morphologies has been studied at or near 1300 C. The specimens with well aligned structure show very low steady state creep rate, high stress exponent value and long rupture life. As the perfection of the microstructure decreases, the steady state creep rate increases and both stress exponent value and rupture life decrease. Moreover, the samples with banding and/or partially dendritic structure show very high strain rate.
Dissert. Abstr.

N79-19138 Northwestern Univ., Evanston, Ill.
FATIGUE CRACK INITIATION AND GROWTH OF MICROCRACKS IN COMMERCIAL PRECIPITATION HARDENED Al-Cu-Mg ALLOYS OF ORDINARY AND HIGH PURITY Ph.D. Thesis
Chung Yuan Kung 1978 173 p
Avail: Univ. Microfilms Order No. 7903302

A 100 to 800 magnification optical microscope was mounted directly on the fatigue machine for the direct observation of microcracks and microstructure in 2024-T4 and 2124-T4 Al alloys. At low stress levels in 2024-T4 about 95% of the initial cracks were associated with constituent particles or pits while in the 2124 alloy which has a low volume fraction of constituent particles and a large grain size less than 50% of the cracks were associated with the particles. At high stress levels the fatigue cracks completely initiated along the slip lines for both the 2124 and 2024 alloys. An attempt was made to explain both modes of crack initiation, the transition in fatigue modes between high and low stress levels in terms of active slip bands and their interaction with particles.
Dissert. Abstr.

N79-19139 Wisconsin Univ. - Madison.
QUANTITATIVE ISLAND SIZE DETERMINATION AND PHASE TRANSITIONS IN A CHEMISORBED OXYGEN LAYER ON TUNGSTEN (110) Ph.D. Thesis
Gwo-ching Wang 1978 332 p
Avail: Univ. Microfilms Order No. 782053

The temperature dependence and angular distribution of intensity of superlattice beams in low-energy electron diffraction from a chemisorbed layer of oxygen on W(110) were measured, as a function of oxygen coverage, substrate temperature, and annealing conditions. In particular, the structure W(110)p(2x1)-O was studied. In order to interpret these measurements, the instrument response function of the diffractometer was obtained by measuring angular profiles of substrate diffraction beams from clean W(110), as a function of diffraction conditions. It was possible to isolate various contributions to the instrument response. The coherence width ranges from 40A to 140A depending on the diffraction conditions. Using these results, superlattice beam widths were interpreted in terms of islands with various distributions of sizes.
Dissert. Abstr.

N79-19140 Northwestern Univ., Evanston, Ill.
GRAIN BOUNDARY CAVITATION AS A RESULT OF HIGH TEMPERATURE FATIGUE AND CREEP IN Cu AND Mg Ph.D. Thesis
Toshiari Saegusa 22 Mar. 1979 118 p
Avail: Univ. Microfilms Order No. 7903356

The role of stress concentrations in promoting the nucleation and growth of grain boundary voids was investigated in high temperature (0.5 Tm) fatigue and creep. The materials studied were 99.999% Cu, 99.9% Cu, and high purity Mg. In the case of the higher purity copper, it was observed that fatigue produces a rapid migration of the grain boundaries from an originally random distribution to one in which most of the boundaries are oriented for maximum shear stress. The boundaries in the 99.9% Cu and in the high purity Mg showed a much smaller tendency to migrate during fatigue. In these materials the highest level of cavitation occurs on those boundaries oriented close to 45 degree to the stress axis. (Three-dimensional maps of grain boundaries were constructed to measure their true orientation with respect to the stress axis.) This result implied that grain boundary sliding is important to cavitation.
Dissert. Abstr.

N79-19141 Rensselaer Polytechnic Inst., Troy, N. Y.
MECHANICAL RESPONSE OF A Ni, Cr, Al-TaC DIRECTIONALLY SOLIDIFIED EUTECTIC UNDER MONOTONIC AND CYCLIC LOADING Ph.D. Thesis
Walter Alexander Johnson 1978 216 p
Avail: Univ. Microfilms Order No. 7903215

High cyclic fatigue tests were conducted at 25 C and 825 C on an aligned Ni, 10wt%Cr,5Al-TaC, directionally solidified (D.S.) pseudobinary eutectic, grown at a rate of 0.635 cm/hr. Gamma prime size and morphology was altered by post solidification heat treatment. Specimens were fatigue tested in air at 25 C and in a vacuum at 0.000003 Torr at 825 C. The 25 C fatigue lives were not drastically affected by heat treatment, but aged specimens demonstrated superior fatigue properties to the as -D.S. at 825 C. Specimen fatigue life was very sensitive to test frequency in the range 0.02 - 20 Hz. Cycles to failure and the time to failure decreased with a reduction in the test frequency. Reduced specimen life was postulated to be the result of enhanced cyclic creep at the lower frequencies.
Dissert. Abstr.

N79-19142 Northwestern Univ., Evanston, Ill.
ROLE OF PLASTIC WORK IN FATIGUE CRACK PROPAGATION IN METALS Ph.D. Thesis
Yoshito Izumi 1978 200 p
Avail: Univ. Microfilms Order No. 7903285

An experimental technique was developed for measuring the plastic work (U) by determining the local stress-strain curves in the plastic zone around the crack tip using tiny foil strain gages. The value of U was calculated by integrating the areas in the hysteresis loops over the plastic zone for a unit area of crack advance. The results for a series of aluminum alloys, steels, and a nickel alloy confirm the importance of U as a rate determining parameter for fatigue crack propagation.
Dissert. Abstr.

N79-19143 California Univ., Berkeley.
THE DEFORMATION OF SUPERPLASTIC ALLOYS AT RELATIVELY LOW STRAIN RATES Ph.D. Thesis
Dionysios Ioannis Grivas 1978 95 p
Avail: Univ. Microfilms Order No. 7904462

The superplastic and sub-superplastic creep properties of Pb-Sn eutectic and Al-Zn eutectoid alloys were studied. Various thermomechanical retreatments were tested to check the possibilities of whether the subsuperplastic deformation mechanism is affected by these treatments. All thermomechanical histories were found to reveal the same stress exponent, which is believed to be indicative of the predominant mechanism. The thermomechanical history of the ingot has a marked effect on the steady state strain rate which cannot be accounted for by the mean grain diameter, indicating that another microstructure characterization parameter is required for the complete representation of the steady state creep data of superplastic alloys. It was found that the creep resistance of the Al-Zn eutectoid alloys can be improved drastically by the additional thermal treatment of homogenizing the alloy in the alpha region and slow cooling to induce the plate like microstructure. The thermomechanical history

was also found to have an effect on the total elongation before failure in this alloy. Dissert. Abstr.

N79-19144 Northeastern Univ., Boston, Mass.
THEORY OF THE TRANSPORT PROPERTIES OF DISORDERED ALLOYS IN THE SINGLE-SITE APPROXIMATIONS Ph.D. Thesis
Sofronios Constantinou Papadopoulos 1978 166 p
Avail: Univ. Microfilms Order No. 7904164

Low temperature transport properties of random substitutional binary alloys A(x)b(l-x) were investigated by generalizing the single-site approximation schemes that were developed successfully for their equilibrium properties, namely the coherent potential approximation and the average T-matrix approximation. The projection operator technique, as developed by Argyres and Kirkpatrick, was used to derive an exact quantum kinetic equation for the configuration average of the statistical density operator, in terms of which the transport coefficients for the disordered alloys were determined. Dissert. Abstr.

N79-19145*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TOUGHNESS-HIGH STRENGTH IRON ALLOY Patent Application
J. R. Stephens and W. R. Witzke, inventors (to NASA) 25 Jan. 1979 11 p
(NASA-Case-LEW-12542-3; US-Patent-Appl-SN-007083) Avail: NTIS HC A02/MF A01 CSCL 11F

An improved steel alloy is described which exhibits both high toughness and high strength at cryogenic temperatures. The alloy consists essentially of about 10 to 16 percent by weight nickel, up to 1.0 percent by weight aluminium, and up to about 3 percent by weight of at least one of the following additional elements: copper, lanthanum, niobium, tantalum, titanium, vanadium, yttrium, zirconium and the rare earth metals, with the balance being essentially iron. The steel alloy is produced by a process which includes using cold rolling at room temperature and subsequent heat treatment at temperatures ranging from 500 deg to 650 C. The alloy possesses a fracture toughness ranging from 200 to 230 ksi in. and yield strengths up to 230 ksi. NASA

N79-19146# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
HYDROGEN INDUCED INTERGRANULAR CRACKING OF NICKEL-BASE ALLOYS
R. M. Latanision, F. T. S. Lee, and M. Kurkela Oct. 1978 18 p refs
(Contract N00014-78-C-0002)
(AD-A062024; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report is intended to summarize the activities pursued during the first year of a program directed toward an evaluation of the susceptibility of nickel and nickel base alloys to embrittlement by cathodically produced hydrogen. Preliminary results suggest that hydrogen permeation in unstrained membranes occurs by lattice diffusion rather than by alternate short circuiting mechanisms. Work is in progress to evaluate the contribution of dislocation transport to the permeation flux. Author (GRA)

N79-19147# McDonnell-Douglas Research Labs., St. Louis, Mo.
INFLUENCE OF RARE-EARTH ADDITIONS ON PROPERTIES AND FRACTURE TOUGHNESS OF Ti-6Al-4V WITH ERBIUM, YTTRIUM, AND UTTRIA ADDITIONS Technical Report, 1 Apr. 1977 - 31 Mar. 1978
C. R. Whitsett, S. M. L. Sastry, J. E. ONeal, and R. J. Lederic May 1978 68 p refs
(Contract N00014-76-C-0626)
(AD-A061804; MDC-Q0654) Avail: NTIS HC A04/MF A01 CSCL 11/6

The influence of additions of 0.1 wt% Er, 0.02 wt% Y, 0.05 wt% Y, and 0.038 wt% Y2O3 on the room-temperature tensile properties and fracture toughness of Ti-6Al-4V was studied. The alloys were cast by consumable-electrode arc-melting in vacuum. Er and Y were added in the form of Ti-25Er and Ti-25Y master alloys, and Y2O3 was added in the form of a fine powder. The alloys, after being forged and rolled, had only about half the nominal concentrations of rare-earth additives. The rolled plates were given various heat treatments to observe the combined effects of microstructure and rare-earth additives. The rare-earths effect grain refinement. The room-temperature tensile properties and fracture toughness of Ti-6Al-4V are not significantly altered by the rare-earths. The crystallographic texture developed during rolling also is unaffected by the rare-earth additives, although Y and Y2O3 effect an increased sharpness of near-transverse-basal texture components in alpha-beta annealed alloy. The uniform elongation of Ti-6Al-4V under tensile stress at high temperatures is increased by Er and Y additions. The high-temperature compressive stress-strain characteristics of heat treated Ti-6Al-4V are not altered by Er and Y.
Author (GRA)

N79-19148# Minnesota Univ., Minneapolis. Dept. of Chemistry.
THE PHYSICAL AND CHEMICAL CHARACTERIZATION OF ELECTROCHEMICALLY REFORMED SILVER SURFACES
John F. Evans, M. Grant Albrecht, Dale M. Ullevig, and Robert M. Hexter Nov. 1978 48 p refs
(Contract N00014-77-C-0209)
(AD-A061634; TR-2) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of electrochemically oxidizing and reducing polycrystalline silver foils in aqueous chloride solutions are studied from a physical and chemical standpoint. Scanning electron microscopy indicates that the resulting surface is extremely rough, consisting of nodular formations. Auger electron spectroscopic, secondary ion mass spectrometric and electrochemical results provide clear indication that a highly purified layer of metallic silver of increased surface area and activity is produced by the electrochemical reformation process. No evidence is found for the retention of intense Raman scatterers such as pyridine at these surfaces under ultrahigh vacuum conditions. The implications of the chemical and physical state of the reformed silver foils is discussed in the context of theories which have been proposed to explain the anomalously intense spectra of Raman scatterers adsorbed from solution onto these reformed silver surfaces.
Author (GRA)

N79-19149# Teledyne CAE, Toledo, Ohio.
ADVANCED TURBINE ENGINE GAS GENERATOR (ATEGG) FRACTOGRAPHY OF CAST NICKEL BASE SUPERALLOYS Final Report, 1 Oct. 1975 - 30 Jun. 1978
Nov. 1978 28 p
(Contract F33657-76-C-0215)
(AD-A061701; TCAE-1567-Vol-4; AFAPL-TR-77-30-Vol-4)
Avail: NTIS HC A03/MF A01 CSCL 11/6

This report documents Teledyne CAE's efforts to correlate the fracture surfaces of cast nickel-base superalloys to known conditions of low cycle fatigue testing (strain range partitioning). Rene: 80 and In-100 low cycle fatigue test specimens (supplied by NASA-Lewis and TRW materials laboratories) were examined by means of scanning electron microscope (SEM). The fractography obtained with the SEM can be compared to actual engine component failures, and will provide strong indications of the metal temperature, creep conditions, strain levels, and cycles imposed, during the events leading to component failure.
Author (GRA)

N79-19150# State Univ. of New York at Stony Brook. Dept. of Materials Sciences.
FEASIBILITY STUDY ON THE USE OF SMALL-ANGLE NEUTRON SCATTERING FOR MICROSTRUCTURAL DETERMINATIONS OF TECHNOLOGICAL ALLOYS, CARRIED OUT AT ATOMIC WEAPONS RESEARCH ESTABLISHMENT (AWRE), ALDERMASTON, ENGLAND Final Report
Herbert Herman 1978 58 p refs
(Contract N00014-78-M-0074)
(AD-A061867) Avail: NTIS HC A04/MF A01 CSCL 11/6

A study was carried out at the Atomic Weapons Research Establishment (AWRE), Aldermaston, England, on the use of small-angle neutron scattering (SANS) for non-destructive evaluation of alloys of technological importance. A range of ferrous and nickel-based superalloys were examined in different conditions. SANS is sensitive to the development of heterogeneities having sufficient scattering power for neutrons. It is concluded that this

method can play an important role in alloy development and long range alloy test programs. Author (GRA)

N79-19151# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology Devices Lab.

MAGNETIC ANISOTROPY IN THE SYSTEMS SAMARIUM 2 (COBALT, IRON) 17 AND SAMARIUM 2 MANGANESE (COBALT, IRON) 16

H. A. Leupold, F. Rothwarf, J. J. Winter, A. Tauber, J. T. Breslin, and A. Schwartz Aug. 1978 20 p refs Presented at 2d Intern. Symp. on Magnetic Coercivity and Anisotropy or Rare Earth-Transition Metal Alloys, San Diego, Calif., 27-30 Jun. 1978

(DA Proj. 1L1-61102-AH-47)

(AD-A061802; DELET-TR-78-16) Avail: NTIS HC A02/MF A01 CSCL 11/6

The anisotropy fields and saturation magnetizations of the samarium-cobalt-iron and samarium-manganese-cobalt-iron 2-17 systems were measured at 4.2 K and 300 K in applied fields up to 100 kOe. The presence of the Mn in the latter system raised the anisotropy fields by as much as 55 percent over those measured for the corresponding compounds in the ternary system. The augmentation of anisotropy was accompanied by a slight decline in the saturation magnetization of approximately 5 percent for the materials with the highest anisotropy fields. The values of the saturation magnetization for the quaternary compounds showed much better temperature stability, increasing by about 5 percent in going from 300 K to 4.2 K as compared to 15 percent for the ternary system. A comparison of the present results with previous anisotropy measurements obtained by extrapolation from applied fields up to 20 kOe showed the latter to be too low by as much as 35 percent. Author (GRA)

N79-19152# Drexel Univ., Philadelphia, Pa.

RAPID CYCLE CASTING OF STEEL Technical Report, 1 Jul. 1977 - 30 Jun. 1978

Diran Apelian and George Langford 30 Jun. 1978 215 p refs

(Contract DAAG29-77-C-0028; ARPA Order 3397)

(AD-A061951; ARO-15284.1-MS) Avail: NTIS HC A10/MF A01 CSCL 13/8

In the SD (diffusion solidification) casting process high carbon liquid iron is brought into contact with low carbon solid iron isothermally, and the liquid solidifies by rejecting carbon to the solid. The solidification mechanism is controlled by mass transfer rather than heat transfer as is the case in conventional castings. Advantages of the SD process over conventional casting processes and products result from (1) lower casting temperatures; (2) elimination of the need for a riser; (3) more rapid solidification; (4) plane-front as opposed to dentritic solidification; and (5) complete solidification under isothermal conditions. Diffusion solidification in the iron-carbon system can produce castings with greater than 99% of the theoretical density; solidification times typically range from a few seconds to several minutes, even for ingot sized castings; and tensile strengths as high as 185,000 psi with 15% reduction of area to break have been attained. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-19153 Pennsylvania State Univ., University Park.

HIGH CURIE TEMPERATURE FERROELECTRICS FOR PIEZOELECTRIC APPLICATIONS Ph.D. Thesis

Augusto Sa Neto 1978 186 p

Avail: Univ. Microfilms Order No. 7902634

This study is primarily concerned with the search for and analysis of new ceramic materials for piezoelectric applications. Materials form single phase compounds with the perovskite structure and are known to exhibit phase transitions to distorted perovskite structures which can occur at high temperatures. A study of optical second harmonic generation from powders was used to distinguish acentric from antiferrodistortive and antiferroelectric forms and thus to ascertain the potential of these compositions for piezoelectric transducer applications. The results obtained showed very low potentiality for the use of these materials as piezoelectric devices. During this study, the compounds were reclassified as centric and acentric structures. The polycrystalline ferroelectric Sr2Nb2O7 was also studied. The compound was synthesized from mixed oxides, using X-ray and electron microprobe analysis to ensure single phase character. Dissert. Abstr.

N79-19154 Massachusetts Univ., Amherst.

THE TENSILE PROPERTIES OF COMPATIBLE GLASSY POLYBLENDS BASED UPON POLY (2,6-DIMETHYL-1,4-PHENYLENE OXIDE) Ph.D. Thesis

Lothar Walter Kleiner 1978 240 p

Avail: Univ. Microfilms Order No. 7902034

The mechanical behavior of compatible glassy polyblends, based upon poly (2,6-dimethyl-1,4-phenylene oxide) (PPO), was investigated. In particular, the influence of composition, molecular weight, and molecular weight distribution upon the large deformation tensile properties was assessed. Various possible correlations between the experimentally determined moduli and theory were considered. Correlations with density, packing density, composite theory and lattice fluid theory were included. Similarities in behavior of the compatible glassy polyblends to the phenomenon known as antiplasticization is presented. The modeling of the properties of these polymer mixtures via Simplex lattice design is also detailed. Finally, attention is given to the development of compatibility criteria based upon the large deformation tensile property and density measurements. Dissert. Abstr.

N79-19155 Purdue Univ., Lafayette, Ind.

EXHAUSTION FIXATION AND COLOR YIELD OF FIBER REACTIVE DYES IN LIQUID AMMONIA TREATED COTTON FABRIC Ph.D. Thesis

Lenore Raisen Basche 1978 155 p

Avail: Univ. Microfilms Order No. 7905694

Liquid ammonia treated cotton print cloth was tested under two ammonia treatment conditions: one in which the cotton was immersed in the dyebath while still saturated with ammonia, and one in which ammonia was removed by water rinse before being placed in the dyebath. Twelve fiber reactive dyes, which were representative of four of the major reactive dye classes and of four different levels of reactivity were selected. Both treatments resulted in an increase in the quantity of dye exhausted onto the fabric during the course of a normal dyeing cycle. The color yield of the cloth was improved as a result of the ammonia treatment. Fabrics from both ammonia treatment groups exhibited greater depth of shade than would be predicted by the amount of dye actually on the fiber. Because the ammonia process swells the fiber and modifies the surface irregularities normally present, light is reflected more regularly giving the appearance of deeper dye shades. Dissert. Abstr.

N79-19156 Kentucky Univ., Lexington.

HERTZIAN FRACTURE OF PYREX GLASS UNDER QUASI-STATIC LOADING CONDITIONS Ph.D. Thesis

Madapusi Kande Keshavan 1978 127 p

Avail: Univ. Microfilms Order No. 7824403

The Hertzian fracture, in which a relatively hard sphere is loaded onto a flat specimen of Pyrex glass under quasi-static loading conditions was studied in three parts. In the first part the effects of the nature of the ball, its size and the surface condition, on the Hertzian fracture behavior were studied. Also the effect of surface condition of Pyrex glass was also investigated. In the second part, energy balance criterion was modified to derive Auebach's Law. It was found that only four percent of the total input energy is used in causing the Hertzian fracture. In the third part the distribution of critical load to cause fracture of the as-received and the abraded Pyrex glass, using different ball sizes, of steel, Al2O3 and WC, were analyzed using Weibull distribution. Dissert. Abstr.

N79-19157 Northwestern Univ., Evanston, Ill.

RUBBER ELASTICITY OF WELL-CHARACTERIZED POLY-BUTADIENE NETWORKS Ph.D. Thesis

Luc Marie Dossin 1978 182 p

Avail: Univ. Microfilms Order No. 7903248

Narrow distribution, linear and 4-arm star polybutadiene, prepared by an anionic polymerization method, were crosslinked in the bulk or in a 50% solution, by high energy electrons. Stress-strain measurements were made in tension at 25 C in a nitrogen atmosphere. Equilibrium data conformed well to the Mooney-Rivlin equation, yielding values of C sub 1 and C sub 2 for each network. The initial modulus, C sub 1 + C sub 2 was found to be the sum of the chemical crosslink contribution predicted by the phantom network theory which omits junction fluctuations entirely, and the topological contribution calculated according to the Langley entanglement trapping theory. The Mooney-Rivlin constant C sub 2 was found to represent approximately one half of the topological contribution while C sub 1 was consistently larger than the prediction of the phantom network theory. A correlation between the equilibrium swelling ratio and the calculated initial modulus was also found to be independent of the molecular weight of the primary chains.
Dissert. Abstr.

N79-19158 Northwestern Univ., Evanston, Ill.
THE INFLUENCE OF MOLECULAR WEIGHT AND ORIENTATION ON THE CRYSTALLIZATION KINETICS OF GLASSY NYLON 6 Ph.D. Thesis
Philip Engler 1978 154 p
Avail: Univ. Microfilms Order No. 7903254

Crystallization of glassy nylon 6 was investigated with differential scanning calorimeter and wide angle X-ray diffractometry in order to determine the individual and combined effects of average molecular weight, molecular weight distribution, and orientation. Crystallization from the glass rather than the melt facilitated comparison of the different responses at high and low undercoolings. Samples were prepared by compression molding the nylon at 270 C and then quenching the molten films between aluminum plattens that had been chilled with liquid nitrogen. These films had number average molecular weights ranging from 10,000 to 42,000 and polydispersity indices ranging from 2.0 to 3.1. Blends of high and low molecular weight nylon resins were used to prepare the samples having broader than most probable distributions. Dissert. Abstr.

N79-19159*# Lockheed-California Co., Burbank.
DEVELOPMENT OF PROCESSES AND TECHNIQUES FOR MOLDING THERMALLY STABLE, FIRE-RETARDANT, LOW-SMOKE-EMITTING POLYMERIC MATERIALS Technical Report, 1 Oct. 1977 - 28 Feb. 1979
B. Silverman Mar. 1979 87 p
(Contract NAS9-15406)
(NASA-CR-151862) Avail: NTIS HC A05/MF A01 CSCL 07C

All available newly developed nonmetallic thermally stable polymers were examined for the development of processes and techniques by compression molding, injection molding, or thermoforming cabin interior parts. Efforts were directed toward developing molding techniques of new polymers to economically produce usable nonmetallic molded parts. Data on the flame resistant characteristics of the materials were generated from pilot plant batches. Preliminary information on the molding characteristics of the various thermoplastic materials was obtained by producing actual parts. Author

N79-19160*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MIXED DIAMINES FOR LOWER MELTING ADDITION POLYIMIDE PREPARATION AND UTILIZATION Patent Application
Terry L. St. Clair, inventor (to NASA) 13 Feb. 1979 12 p
(NASA-Case-LAR-12054-2; US-Patent-Appl-SN-011737) Avail: NTIS HC A02/MF A01 CSCL 07C

An essentially solventless process is presented for preparing addition type polyimide prepreg that retains good drape, tack and other mechanical properties. NASA

N79-19161# Naval Research Lab., Washington, D. C.
GLASS RELAXATION KINETICS: DYNAMIC ACTIVATION ENERGY ASSUMPTION Final Report
Robert D. Corsaro and Jacek Jarzynski 17 Nov. 1978 17 p refs
(AD-A061790; NRL-8270) Avail: NTIS HC A02/MF A01 CSCL 11/2

The assumption was made that the activation energy of a relaxation process can change slightly (-4%) as the system relaxes. The empirical consequences of such an assumption are as follows: the normally exponential decay function becomes more gradual or broadened in precisely the manner observed for glass and polymer relaxations; the well-known fractional-exponential expression for the response function is easily obtained; a well-defined temperature dependence is predicted for the width parameter b, which is in excellent agreement with recent measurements on B2O3 glass; and conventional finite-amplitude (nonlinear) correction terms can be introduced in a more unified manner than was previously possible. A simple physical justification for this time-dependent activation energy is that the structural units that relax later encounter a somewhat larger activation barrier than do the units that relax first. Author (GRA)

N79-19162# Boeing Commercial Airplane Co., Seattle, Wash.
ANODIZE OPTIMIZATION AND ADHESIVE EVALUATIONS FOR REPAIR APPLICATIONS Final Report, 1 Dec. 1976 - 30 Jul. 1978
M. C. Locke, R. E. Horton, and J. E. McCarty Jul. 1978 123 p
(Contract F33615-73-C-5171)
(AD-A061758; AFML-TR-78-104) Avail: NTIS HC A06/MF A01 CSCL 13/8

This report covers a two-task follow-on program to investigate phosphoric acid non-tank anodize process optimization and evaluation of adhesive/surface preparation combinations. Work completed in Task I included investigating non-tank anodizing process variables of voltage, time, temperature, and rinse delay. Other parameters studied included the effect of anodizing over titanium and aluminum fasteners, battery anodizing, anodizing mode, and identification of common errors occurring in non-tank anodizing. Following the anodizing variable investigation, bond verification tests were conducted to assess bondability of representative RT,250 F, and 350 F cure adhesive systems. This work served as a basis for selecting the phosphoric acid non-tank anodize process parameter/conditions for Task II. The Task I work is reported in AFML-TR-78-7. Task II was aimed at developing a data base to facilitate repair bonding. Surface preparation methods including optimized FPL etch, and two hand-clean procedures, phosphoric acid non-tank anodize (PANTA) and PasaJell 105, were evaluated. Bondability and environmental durability of current and on-coming adhesive systems from TR,250 F, and 350 F cure categories were determined. Autoclave bonds versus vacuum bag bonds were compared.
Author (GRA)

N79-19163# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
PHOTOACTIVATION OF POLYMER-ANCHORED CATALYSTS: IRON CARBONYL-CATALYZED REACTIONS OF ALKENES Interim Technical Report
R. D. Sanner, R. G. Austin, M. S. Wrighton, W. D. Honnick (Ala., Univ., Univ.), and C. U. Pittman, Jr. (Ala. Univ., Univ.) 11 Nov. 1978 28 p refs
(Contracts N00014-75-C-0880; N00014-75-C-0689)
(AD-A061773; TR-11) Avail: NTIS HC A03/MF A01 CSCL 07/4

Photoactivation of polymer-anchored iron carbonyl catalysts is reported. Prototypic reactions are 1-pentene isomerization and reaction of 1-pentene with HSiEt3 which can be photocatalyzed at 25 C by near-uv irradiation of suspensions of the polymer-anchored catalyst systems. The basic polymer system is a styrene/1% divinylbenzene resin derivatized either with -PPh2 or -P(Ph)CH2CH2PPh2 anchoring sites for catalyst precursors. Fe(CO)n (n = 3,4) are attached to the phosphine sites by reaction with Fe3(CO)12. The polymer-anchored catalysts show turnover numbers exceeding 20000 in some cases, and observed quantum yields exceed unity, evidencing the photogeneration of a thermal catalyst. The data allow the conclusion that the anchoring Fe-P bond is relatively photoinert and that the catalysis is initiated by the photoinduced dissociation of CO from the Fe(CO)n moieties. The catalytic chemistry for the polymer systems parallels that found using homogeneous Fe(CO)n(PPh3)5-n (n = 3,4) model photochemical catalyst precursors. Author (GRA)

N79-19164# Vermont Univ., Burlington. Dept. of Chemistry.
NOVEL PROPENYLFLUOROPHOSPHAZENE-STYRENE COPOLYMERS
Christopher W. Allen and John G. DuPont Oct. 1978 11 p refs
(Contract N00014-77-C-0605)
(AD-A061740; TR-3) Avail: NTIS HC A02/MF A01 CSCL 11/9

The preparation of organofunctional cyclotriphosphazenes and the copolymerization of one of these materials, 2-(2-propenyl) pentafluorocyclotriphosphazene, with styrene to produce fire retardent styrene copolymers is described. The physical and chemical properties of the new copolymers are discussed.
Author (GRA)

N79-19165# Illinois Inst. of Tech., Chicago. Dept of Metallurgical and Materials Engineering.
THE INFLUENCE OF THERMO-MECHANICAL TREATMENTS ON THE FRACTURE OF POLYMERS Final Report, Jun. 1975 - 31 May 1978
Lawrence J. Broutman 25 Sep. 1978 9 p refs
(Grants DAHC04-75-G-0169; DAHC04-77-G-0160)
(AD-A062999; ARO-12710.1-MS) Avail: NTIS HC A02/MF A01 CSCL 11/9

This report summarizes the objectives of the research contract and lists the graduate students receiving financial support from this contract and the degrees which the students earned. Also, a list of publications resulting from this research is presented.
Author (GRA)

N79-19166# MSA Research Corp., Evans City, Pa.
DEVELOPMENT OF A STABLE HIGH EXPANSION WATER-BASED FOAM Final Report, 23 Sep. 1977 - 1 Dec. 1978
Joseph V. Friel 27 Nov. 1978 28 p refs
(Contract DAAK70-77-C-0220)
(AD-A061936; MSAR-78-89) Avail: NTIS HC A03/MF A01 CSCL 11/9

The objective of this program was the development of a long life water based surfactant foam capable of being generated at a 1000/1 expansion using a 5% concentrate. Half of the generated foam was to last for 24 hours at which time the foamed mass should be capable of conforming to the surface of an intruded object. In addition, foamed masses were to be capable of being built to a 10 foot height within a 30 foot diameter spread distance. In this study a long life foam formulation was developed largely on the basis of a comprehensive screening program. The developed formulation consisted of polyethyleneimine, glycerin, sorbitol, lithium chloride and MSA salt water foam agent. The developed recipe yielded foams which meet the design goals for life, expansion and concentration usage. As foams aged they dried to a closed cell but delicate structure. This loss of fluidity prevented the foam from conforming to an intruding object. Large scale field tests showed that aged foams were vulnerable to wind gusts and that spread distances of over 50 feet would be required to achieve foam heights of 10 feet.
Author (GRA)

N79-19167# Pennsylvania State Univ., University Park. Dept. of Chemistry.
THE SYNTHESIS, DEGRADATION, AND STRUCTURE OF POLYPHOSPHAZENES Final Technical Report, 1 May 1975 - 31 Aug. 1978
Harry R. Allock 6 Nov. 1978 4 p refs
(Grant DAHC04-75-G-0143)
(AD-A061893; ARO-13078.5-C) Avail: NTIS HC A02/MF A01 CSCL 07/3

Poly(organophosphazenes) and their cyclic oligomeric analogs have been used as ligands for transition metal complexes. X-Ray structural work has shown that platinum binds to the skeleton of specific organophosphazenes. X-ray structural work and conformational energy calculations have been used to deduce the relationships between structure and properties in polyphosphazenes.
Author (GRA)

N79-19034*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
KINETICS DATA FOR DIFFUSION OF OUTGAS SPECIES FROM RTV 560
C. K. Liu and A. P. M. Glassford *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 289-308 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 07C

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-19168 Illinois Inst. of Tech., Chicago.
SEPARATION OF HYDROGEN FROM COAL DERIVED GAS MIXTURE USING Fe SUB XTiNi SUB 1 MINUS X AND LaNi SUB 4 Cu ALLOYS Ph.D. Thesis
Virendra Haridas Cholera 1978 146 p
Avail: Univ. Microfilms Order No. 7902990

An energy efficient separation process is developed to separate hydrogen from coal-derived gas mixtures. The proposed metal hydride separation process not only separates hydrogen from gas mixtures but also compresses the high-purity hydrogen, thus essentially converting low-level regeneration heat into work of separation and compression.
Dissert. Abstr.

N79-19169 Oklahoma State Univ., Stillwater.
CATALYST AGING TESTS AND THE ROLE OF CATALYST WETTING ON HYDRODESULFURIZATION OF A COAL DERIVED LIQUID Ph.D. Thesis
Dhirendra Chhotalal Mehta 1978 253 p
Avail: Univ. Microfilms Order No. 7903708

A trickle bed reactor was selected to study the hydrodesulfurization of raw anthracene oil, a coal derived oil, over various commercially available Co-Mo-Alumina catalysts. The experimental equipment was designed for operating conditions ranging from ambient to 850 F (455 C) and 1,800 psig pressure. The hydrodesulfurization studies were conducted at reactor temperatures of 600,650,700 and 750 F (314,343,371and 399 C), at pressure of 500,1,000 and 1,500 psig and at liquid volume hourly space times ranging from 0.325 to 1.480 hours. The hydrotreating catalysts were also tested for their aging characteristics during 200-hour runs at steady reactor conditions of 700 F (371 C), 1,000 psig and 0.44 liquid weight hourly space time. Constant amounts of catalyst, 20 grams, were used for all the experimental runs. Various kinetic models were tested for their relative fit to the results of the study.
Dissert. Abstr.

N79-19170*# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
DEVELOPMENT OF METHODS OF CHARACTERIZING COAL IN ITS PLASTIC STATE Final Report
William G. Lloyd 16 Jul. 1978 169 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954920)
(NASA-CR-158371) Avail: NTIS HC A08/MF A01 CSCL 21D

Coal in its plastic state (typically 400-460 C) was examined by the isothermal Gieseler plastometry of seven selected coals of widely varying plastic properties. Kinetic models were proposed for the isothermal plastometric curves. Plastic behavior was compared with a variety of laboratory analyses and characterizations of these coals, including classical coal analysis; mineral analysis; microstructural analysis (extractable fractions, surface area measurement, and petrographic analysis); and thermal analysis (thermogravimetric analysis, thermomechanical analysis, and differential scanning calorimetry). The phenomenon of a sharp, large, poorly reproducible exotherm in the differential scanning calorimetric analysis of coking coals was examined. Several coal extrudates show mineral distribution, organic maceral composition and overall calorific value to be little affected by 800 F extrusion. Volatile matter and plastic properties are moderately reduced, and the network structure (as gauged by extractables) appears to be slightly degraded in the extrusion process.
L.P.

N79-19171# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.

METHANE UTILIZATION FROM COALBEDS FOR POWER GENERATION Quarterly Technical Progress Report, 1 Dec. 1977 - 1 Apr. 1978
1 Apr. 1978 12 p
(Contract EY-77-C-21-8098)
(TID-28408) Avail: NTIS HC A02/MF A01

Technical progress is reported in engineering a system to demonstrate the economic utilization of mine gas (a diluted mixture of methane and air) as a fuel for gas turbine/electrical generator conversion of mine gas to electrical energy. Aspects reviewed include modification of the Saturn engine to use gaseous fuel, design of skid mounted interface equipment, the use of existing gob degasification boreholes as a fuel source, fuel analysis, safety review, electrical power interface, environmental impact, economic analysis, and fuel reservoir characteristics. A.R.H.

N79-19172# Materials Research Labs., Melbourne (Australia).
RDX/POLYETHYLENE WAX COMPOSITIONS AS PRESSED EXPLOSIVES
William S. Wilson Sep. 1978 45 p refs
(MRL-R-722; AR-001-354) Avail: NTIS HC A03/MF A01

The preparation and sensitivity of explosive formulations prepared from RDX and an emulsifiable polyethylene wax are described. The compaction of these explosive compositions, the sensitivity of the resultant charges to shock and their velocity of detonation are also discussed. Author

N79-19173# TRW Systems, Redondo Beach, Calif.
APPLICABILITY OF PETROLEUM REFINERY CONTROL TECHNOLOGIES TO COAL CONVERSION Final Report, Jul. 1977 - Aug. 1978
M. Ghassemi, D. Strehler, K. Crawford, and S. Quinlivan Oct. 1978 127 p refs
(Contract EPA-68-02-2635)
(PB-288630/7; EPA-600/7-78-190) Avail: NTIS HC A07/MF A01 CSCL 07A

This is part of a comprehensive program for the environmental assessment of high-Btu gasification technology. Process/waste streams from coal gasification and liquefaction processes were characterized. Streams with refinery counterparts were identified. Toxicological and health effects data were also collected on waste stream constituents. Control technologies used in refineries to manage the identified streams were evaluated and their applicability to counterpart coal conversion streams was assessed. Study results indicate that, despite similarities between the refinery process/waste streams and their coal conversion counterparts, significant composition differences between the analogous streams would affect applicability and design of a control technology. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-19174*# RCA Labs., Princeton, N. J.
DEVELOPMENT AND EVALUATION OF DIE MATERIALS FOR USE IN THE GROWTH OF SILICON RIBBONS BY THE INVERTED RIBBON GROWTH PROCESS. TASK 2: LSSA PROJECT Quarterly Report, 1 Oct. - 31 Dec. 1978
M. T. Duffy, S. Berkman, H. I. Moss, and G. W. Cullen Dec. 1978 16 p Prepared from JPL
(Contracts NAS7-100; JPL-954901)
(NASA-CR-158357; PRRL-78-CR-7; DOE/JPL-954901-78/5; QR-5) Avail: NTIS HC A02/MF A01 CSCL 13H

Several ribbon growth experiments were performed from V-shaped dies coated with CVD Si3N4. The most significant result was the ability to perform five consecutive growth runs from the same die without mechanical degradation of the die through temperature cycling. The die was made from vitreous carbon coated with CVD Si3N4. Silicon oxynitride, Si2N2O, was examined with respect to thermal stability in contact with molten silicon. The results of X-ray analysis indicate that this material is converted to both alpha - and beta-Si3N4 in the presence of molten silicon. Experiments on the stability of CVD SiOxNy shoe that this material can be maintained in contact with molten silicon (sessile drop test) for greater than 30 h at 1450 C without total decompositon. These layers are converted mainly to beta-Si3N4. G.Y.

N79-19175*# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
SILICON ON CERAMIC PROCESS: SILICON SHEET GROWTH AND DEVICE DEVELOPMENT FOR THE LARGE-AREA SILICON SHEET AND CELL DEVELOPMENT TASKS OF THE LOW-COST SOLAR ARRAY PROJECT Quarterly Report, 30 Sep. - 31 Dec. 1978
P. W. Chapman, J. D. Zook, J. D. Heaps, C. Pickering, B. L. Grung, B. Koepke, and S. B. Schuldt 31 Jan. 1979 62 p refs Prepared for JPL
(Contract JPL-954356)
(NASA-CR-158370; DOE/JPL-954356-78/4; QR-10) Avail: NTIS HC A04/MF A01 CSCL 13H

The technical and economic feasibility of producing solar cell quality sheet silicon was investigated. It was hoped this could be done by coating one surface of carbonized ceramic substrates with a thin layer of large-grain polycrystalline silicon from the melt. Work was directed towards the solution of unique cell processing/design problems encountered with the silicon-ceramic (SOC) material due to its intimate contact with the ceramic substrate. Significant progress was demonstrated in the following areas; (1) the continuous coater succeeded in producing small-area coatings exhibiting unidirectional solidification and substatial grain size; (2) dip coater succeeded in producing thick (more than 500 micron) dendritic layers at coating speeds of 0.2-0.3 cm/sec; and (3) a standard for producing total area SOC solar cells using slotted ceramic substrates was developed. G.Y.

N79-19176# Purdue Univ., Lafayette, Ind. School of Civil Engineering.
SYSTEM IDENTIFICATION, DAMAGE ASSESSMENT, AND RELIABILITY EVALUATION OF STRUCTURES
Edward C. Ting, S. J. Hong Chen, and James T. Yao Feb. 1978 69 p refs
(Grant NSF ENV-77-05290)
(PB-288889/9; CE-STR-78-1; NSF/RA-780325) Avail: NTIS HC A04/MF A01 CSCL 13B

Available literature on the methods of structural identification, damage assessment, and reliability evaluation are reviewed and summarized. The possibility of combining those techniques into a rational procedure for practical implementation is discussed. System identification is a process for constructing a mathematical description or model of a physical system when both the input to the system and the corresponding output are known. For most of the current applications, the input is usually a forcing function and the output is the displacement or other motions of the structure subjected to the forces. The mathematical model obtained from the identification process should produce a response that in some sense matches closely the system's output, when it is subjected to the same input. GRA

N79-19177# Cornell Univ., Ithaca, N. Y. Dept. of Structural Engineering.
SHEAR TRANSFER ACROSS CRACKS IN REINFORCED CONCRETE
Rafael Jimenez-Perez, Peter Gergely, and Richard N. White Aug. 1978 375 p
(Grants NSF ATA-73-03168; NSF ATA-76-23896)
(PB-288885/7; NSF/RA-780328) Avail: NTIS HC A16/MF A01 CSCL 13C

Tests were conducted to determine the behavior of the shear transfer mechanism in cracked secondary nuclear containment vessels. Simplified equations were developed to describe the first loading cycle stiffness exhibited by both the interface shear transfer and dowel action mechanism. A bi-linear idealization was proposed for the experimental hystersis curve of each mechanism together with the corresponding stiffness coefficients. Equations were derived from a nonlinear regression analysis for the splitting failure force for axial or dowel forces, and for their interaction. An equation was also proposed for the ultimate shear stress that can be transferred across a precracked shear plane. GRA

N79-19178# Washington Univ., St. Louis, Mo. Dept. of Civil Engineering.
MATERIAL AND DIMENSIONAL PROPERTIES OF AN ELEVEN-STORY REINFORCED CONCRETE BUILDING Final Report
R. A. Gardiner and D. S. Hatcher Aug. 1978 107 p refs
(Grant NSF ENV-76-08244)
(PB-288891/5; RR-52) Avail: NTIS HC A06/MF A01 CSCL 13M

Full-scale destructive testing of an eleven-story reinforced concrete structure was conducted. Objectives were to investigate the in-situ structural dimensions and material properties, to determine the dynamic characteristics of the structure by small amplitude shaking tests, and to observe the structural damage and the degradation of the dynamic characteristics due to large amplitude shaking tests. This investigation concerns only the study of the in-situ structural dimensions and material properties. The methods used in the determination of the strength of the materials in the structure and the results obtained thereby are reported. GRA

N79-19179# National Bureau of Standards, Washington, D. C. Center for Building Technology.
PLAN FOR THE ASSESSMENT AND IMPLEMENTATION OF SEISMIC DESIGN PROVISIONS FOR BUILDINGS Final Report
Charles C. Culver, Robert E. Chapman, Patrick W. Cooke, Bruce R. Ellingwood, and S. G. Fattal Oct. 1978 31 p
(Grant NSF ENV-77-15084)
(PB-288762/8; NBSIR-78-1549) Avail: NTIS HC A03/MF A01 CSCL 13M

The plan was prepared based on comments received from a broad spectrum of representatives of the building community. The National Bureau of Standards invited participation from a broad spectrum of interests to help develop the plan. Trade associations, industry groups, professional organizations, the model code organizations, standards organizations and Federal agencies were included; groups with national representation rather than regional or local interest were selected. The plan includes four phases (1) Review and Refine Tentative provisions, (2) Trial Designs and Impact Assessment, (3) Consideration and Adoption of Provisions, and (4) Assistance to Facilitate Implementation. It can form the basis for the assessment and implementation of the tentative seismic design provisions. GRA

N79-19180# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
EVALUATION OF COLD PLANERS FOR GRINDING PCC PAVEMENTS Final Report, 1977 - 1978
B. F. Neal and J. H. Woodstrom Sep. 1978 31 p refs
(PB-288796/6; TL-633218; FHWA/CA/TL-78-15) Avail: NTIS HC A03/MF A01 CSCL 13C

Attempts by two contractors to use cold planing equipment to restore riding quality to faulted PCC pavements are reported. It was found that while the equipment could remove substantially all faulting and greatly improved riding quality, there was severe damage to the concrete adjacent to random cracks and transverse joints in spite of condiderable effort to prevent it. Because of this damage, the equipment as tested was not considered satisfactory for grinding PCC pavements. GRA

N79-19181# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.
VIBRATORY COMPACTION OF ASPHALT CONCRETE Interim Report
Robert J. Nittinger Aug. 1978 41 p refs Sponsored in part by DOT
(PB-288744/6; RR-64; FHWA/NY-78/RR/64; IR-3) Avail: NTIS HC A03/MF A01 CSCL 13C

A total of 10 different roller models were used on 10 contracts-3 overlays and 7 new constructions. Discovery of two important operating parameters resulted in development of performance criteria applicable to any roller. These parameters the spacing of drum impacts and their magnitude can be controlled by adjusting forward speed, and drum amplitude. Impact magnitude was correlated with layer thickness to produce the ranges necessary for each lift. The force necessary for adequate compaction increased with lift thickness, but on lifts thinner than 3 in., the maximum force applied was found to be equally critical. If too great, roller rebound occurred, reducing densities. Vibratory rollers also compacted single-lift wearing and base courses-respectively 2 1/2 and up to 8 in.--more efficiently than conventional rolling. In sum, vibratory rollers when operated properly were found to be effective in compacting asphalt concrete. Also rather than accept or reject rollers individually, operating criteria were developed to determine the ability of any roller to compact a given lift thickness. GRA

N79-19182# Montana State Highway Dept., Helena. Materials Bureau.
PREDICTING MOISTURE INDUCED DAMAGE TO ASPHALT CONCRETE DESIGN MIXES Final Report, 1974 - 1978
Bradley J. Bruce 30 Jun. 1978 113 p Sponsored in part by DOT
(PB-288788/3; FHWA/MT-7926-02) Avail: NTIS HC A06/MF A01 CSCL 13C

Many asphalt, aggregate, mineral filler, and chemical additive combinations were tested for the correlation of the 'E' Modulus Test with visual assessment of the condition of the asphalt aggregate specimen and the results of other test methods including Marshall Method, Resilient Modulus, Immersion Compression and Maximum Tensile Stress. Specimens used in conventional tests were treated in the manner prescribed by the method. Specimens for 'E' Modulus, Resilient Modulus and Maximum Tensile Stress were tested both before and after subjecting them to severe artificial conditions that were conceived as comparable to several years of natural exposure to the elements. 'E' Modulus was judged to be too inconsistent with other variables to be used as an acceptable criteria. The data suggest that Maximum Tensile Stress and Resilient Modulus tests would be valid tools for the evaluation of asphalt aggregate susceptibility to moisture damage. Immersion Compression data could be interpreted to provide information about stripping resistance and could serve to aid in the fabrication of mixes with reduced moisture susceptibility. The Marshall Method Testing provided inconsistent indications of moisture susceptibility using either flow or stability values. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N79-19183 Purdue Univ., Lafayette, Ind.
ZINC OXIDE ON SILICON SURFACE ACOUSTIC WAVE DEVICES FOR SIGNAL PROCESSING AND FREQUENCY CONTROL Ph.D. Thesis
John Kiefer Elliott 1978 200 p
Avail: Univ. Microfilms Order No. 7905715

The signal processing capability of metal-zinc oxide-silicon dioxide-silicon (MZOS) convolvers was improved by utilizing the high coupling characteristics of Sezawa waves. A prototype Sezawa wave convolver was fabricated and tested to determine its efficiency and bandwidth. A 3 db bandwidth of MHz was observed along with a tuned convolution efficiency of -57 dbm. A theoretical model for interdigital transducers coupled to Sezawa waves was developed. This model explains the severe distortion of the frequency response of Sezawa mode devices having 20 finger pair interdigital transducers. A MZOS surface wave resonator designed, fabricated, and evaluated. Faco Factors influencing the Q in such devices were identified. Dissert. Abstr.

N79-19184 California Univ., Berkeley.
COVERT COMMUNICATION CHANNELS IN TIMESHARING SYSTEMS Ph.D. Thesis
Jeffrey Craig Huskamp 1978 313 p
Avail: Univ. Microfilms Order No. 7904486

In many timesharing systems, the subsystems executed to perform a job are written by several different people. For example, the system I/O routines written by the system group are frequently invoked by other users. To provide security in this case, the

operating system must provide confinement for subsystems in a job (senders) that might leak information through covert channels. One typical covert channel that is present in virtually all timesharing systems makes use of the CPU scheduling algorithm. The CPU scheduling covert channel to determine whether the amount of covert information leakage is significant, to explore the factors that influence the amount of leakage, and to determine the feasibility of partial confinement, which trades off leakage for computation cost is studied. Dissert. Abstr.

N79-19185 Colorado Univ. at Boulder.
ELECTROMAGNETIC REMOTE SENSING OF ONE-DIMENSIONAL DIELECTRIC PROFILES Ph.D. Thesis
Wolfgang A. Bereuter 1978 174 p
Avail: Univ. Microfilms Order No. 7903023

Three inversion theories are developed. In the first problem the medium is backed by a conducting plane located at a depth known in advance. It is shown that a special purpose four-parameter family of basis profiles together with the WKB-form for the input admittance enables one to invert scattering data with unprecedented ease. When nothing is known a priori about the termination, a time-domain inversion method for arbitrary sensing pulses is devised. This scheme is easily implemented, particularly when the pulse dispersion over the sensing depth is small, i.e., low loss media. In the third approach the difficulty posed by the loss is overcome by investigating the problem in the frequency domain. Over a narrow band the medium loss can be characterized mathematically by a loss tangent. The medium is treated as a transmission line consisting of non-uniform sections. Each section is sensed separately, and thus the profile is reconstructed in a step-by-step manner. Dissert. Abstr.

N79-19186* National Aeronautics and Space Administration. Pasadena Office, Calif.
ELECTROMAGNETIC RADIATION ENERGY ARRANGEMENT Patent
Robert R. Lipkis (Thompson, Ramo Wooldridge, Inc., Cleveland) and John E. Vehrencamp, inventors (to NASA) (Thompson Ramo Wooldridge, Inc., Cleveland) Issued 16 Mar. 1965 4 p Filed 26 May 1961 Sponsored by NASA
(NASA-Case-WOO-00428-1; US-Patent-3,173,801; US-Patent-Appl-SN-112999; US-Patent-Class-117-35) Avail: US Patent and Trademark Office CSCL 20N

A solar energy collector and infrared energy reflector is described which comprises a vacuum deposited layer of aluminum of approximately 200 to 400 Angstroms thick on one side of a substrate. An adherent layer of titanium with a thickness of between 800 and 1000 Angstroms is vacuum deposited on the aluminum substrate and is substantially opaque to solar energy and substantially transparent to infrared energy.
Official Gazette of the U.S. Patent and Trademark Office

N79-19187*# Axiomatix, Los Angeles, Calif.
SHUTTLE ORBITER KU-BAND RADAR/COMMUNICATIONS SYSTEM DESIGN EVALUATION Final Report
12 Feb. 1979 410 p refs
(Contract NAS9-15515)
(NASA-CR-160135; R7902-2) Avail: NTIS HC A18/MF A01 CSCL 17I

An expanded introduction is presented which addresses the in-depth nature of the tasks and indicates continuity of the reported effort and results with previous work and related contracts, and the two major modes of operation which exist in the Ku-band system, namely, the radar mode and the communication mode, are described. The Ku-band radar system is designed to search for a target in a designated or undesignated mode, then track the detected target, which might be cooperative (active) or passive, providing accurate, estimates of the target range, range rate, angle and angle rate to enable the orbiter to rendezvous with this target. The radar mode is described along with a summary of its predicted performance. The principal sub-unit that implements the radar function is the electronics assembly 2(EA-2). The relationship of EA-2 to the remainder of the Ku-band system is shown. A block diagram of EA-2 is presented including the main command and status signals between EA-2 and the other Ku-band units. F.O.S.

N79-19188*# Axiomatix, Los Angeles, Calif.
RANGING AND TRACKING SYSTEM FOR PROXIMITY OPERATIONS, PHASE 1 Final Report
Sergei Udalov and Peter W. Nilsen 30 Jan. 1979 172 p refs
(Contract NAS9-15666)
(NASA-CR-160125; R7901-5) Avail: NTIS HC A08/MF A01 CSCL 17I

A study task is reported which is directed towards developing a conceptual design of a small, lightweight range and range rate radar sensor system to meet NASA's requirements for accurate short-range and velocity measurements in an orbital environment. Within the context of the requirements, the short range implies system operation at 0 m to 1850 m (6000 ft) and accurate implies a range measurement to within 1 sigma accuracy of 0.20 m (0.67 ft) and a range rate (velocity) measurement to within 1 sigma accuracy of 0.01 m/sec (0.033 ft/sec). G.Y.

N79-19189*# Axiomatix, Los Angeles, Calif.
SHUTTLE KU-BAND AND S-BAND COMMUNICATIONS IMPLEMENTATIONS STUDY Final Report
Gaylord K. Huth, Teferi Nessibou, Peter W. Nilsen, Marvin K. Simon, and Charles L. Weber 28 Feb. 1979 160 p refs
(Contract NAS9-15240)
(NASA-CR-160127; R7902-3) Avail: NTIS HC A08/MF A01 CSCL 17B

The interfaces between the Ku-band system and the TDRSS, between the S-band system and the TDRSS, GSTDN and SGLS networks, and between the S-band payload communication equipment and the other Orbiter avionic equipment were investigated. The principal activities reported are: (1) performance analysis of the payload narrowband bent-pipe through the Ku-band communication system; (2) performance evaluation of the TDRSS user constraints placed on the S-band and Ku-band communication systems; (3) assessment of the shuttle-unique S-band TDRSS ground station false lock susceptibility; (4) development of procedure to make S-band antenna measurements during orbital flight; (5) development of procedure to make RFI measurements during orbital flight to assess the performance degradation to the TDRSS S-band communication link; and (6) analysis of the payload interface integration problem areas. F.O.S.

N79-19190*# Axiomatix, Los Angeles, Calif.
SHUTTLE PAYLOAD S-BAND COMMUNICATIONS STUDY Final Report
J. C. Springett 9 Mar. 1979 196 p refs
(Contract NAS9-15240)
(NASA-CR-160136; R7903-1) Avail: NTIS HC A09/MF A01 CSCL 17B

The work to identify, evaluate, and make recommendations concerning the functions and interfaces of those orbiter avionic subsystems which are dedicated to, or play some part in, handling communication signals (telemetry and command) to/from payloads (spacecraft) that will be carried into orbit by the shuttle is reported. Some principal directions of the research are: (1) analysis of the ability of the various avionic equipment to interface with and appropriately process payload signals; (2) development of criteria which will foster equipment compatibility with diverse types of payloads and signals; (3) study of operational procedures, especially those affecting signal acquisition; (4) trade-off analysis for end-to-end data link performance optimization; (5) identification of possible hardware design weakness which might degrade signal processing performance. F.O.S.

N79-19191*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
FEASIBILITY STUDY OF GRAPHITE EPOXY ANTENNA FOR A MICROWAVE LIMB SOUNDER RADIOMETER (MLSR) Final Report
7 Feb. 1979 81 p Prepared for JPL
(Contracts NAS7-100; JPL-955258)
(NASA-CR-158351; TRW-8710.7.79-3) Avail: NTIS HC A05/MF A01 CSCL 09C

Results are presented of a feasibility study to design graphite epoxy antenna reflectors for a jet propulsion laboratory microwave

limb sounder instrument (MLSR). Two general configurations of the offset elliptic parabolic reflectors are presented that will meet the requirements on geometry and reflector accuracy. The designs consist of sandwich construction for the primary reflectors, secondary reflector support structure and cross-tie members between reflector pairs. Graphite epoxy materials of 3 and 6 plies are used in the facesheets of the sandwich. An aluminum honeycomb is used for the core. A built-in adjustment system is proposed to reduce surface distortions during assembly. The manufacturing and environmental effects are expected to result in surface distortions less than .0015 inch and pointing errors less than .002 degree. Author

N79-19192# Communications Research Centre, Ottawa (Ontario). Radio and Radar Branch.

A RADIO NOISE ANALYZER

W. R. Lauber and J. M. Bertrand Jan. 1979 54 p refs
(CRC-TN-696) Avail: NTIS HC A04/MF A01

Equipment which has been constructed at the Communications Research Center to measure statistical distributions of radio noise is described. The analyzer in its present configuration may be used with either of two receivers, thus giving a frequency coverage from 150 kHz to 1 GHz. The equipment can make measurements of amplitude probability distributions and average crossing rate characteristics; however, plans are given for modifying the equipment to enable measurements of pulse spacing and pulse duration distributions. System-performance tests for both gaussian and impulse noise are given. Detailed circuitry and the operational procedures of the analyzer are described. L.P.

N79-19193# Communications Research Centre, Ottawa (Ontario). Space Technology and Applications Branch.

FORWARD ERROR-CORRECTION FOR THE AERONAUTICAL SATELLITE COMMUNICATIONS CHANNEL

A. Sewards, L. Beaudet (Miller Communications Systems Ltd.), and H. Ahmed (Miller Communications Systems Ltd.) Feb. 1979 20 p refs Presented at AGARD Symp. on Digital Communications in Avionics, Jun. 1978
(CRC-TN-698) Avail: NTIS HC A02/MF A01

The effects of ocean-surface multipath on an L-band aeronautical satellite communications channel are examined. It shows that data messages transmitted over the channel exhibit unacceptably high error-rates under typical conditions. Channel characteristics and techniques for reducing the error-rate are discussed, leading to the choice of a diffuse threshold-decodable convolutional forward error-correcting code. Two implementations of coder/decoders for this code are described, one using standard IC logic, and the other a Z-80A microprocessor. Results of tests of the IC coder/decoder with noise, data error bursts, and a system simulator are quoted, which show that the codec performed as expected and is capable of reducing the error-rate to 0.000010 or better. J.M.S.

N79-19194*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

COAXIAL PHASED ARRAY ANTENNA Patent Application

Haynes Ellis, Jr., inventor (to NASA) (Rockwell International, Downey, Calif.) Filed 17 Oct. 1978 30 p Sponsored by NASA
(NASA-Case-MSC-16800-1; US-Patent-Appl-SN-953313) Avail: NTIS HC A03/MF A01 CSCL 20N

An antenna array for communicating circularly polarized electromagnetic radiation is described. A pair of open ended antenna cavities is coaxially constructed and operates by excitation of linear radiation elements arranged within each of the cavities. A pair of crossed-dipole radiation devices is centered with the cavity and operated by means of a phase-shifting network circuit to transmit as well as receive circularly polarized radiation. Four monopole radiation devices are symmetrically arranged to operate in the outer cavity in phase quadrature by means of the phase-shifting network circuit to also transmit and receive circularly polarized radiation. Combined operation of the two antenna cavities with a 180 deg phase differential between the fields related to the two cavities provides a broad beam, relatively wide frequency bandwith communication capability. Particular embodiments disclosed feature a generally square cavity array as well as a circular cavity array. NASA

N79-19195*# National Aeronautics and Space Administration. Pasadena Office, Calif.

MULTIBEAM SINGLE FREQUENCY SYNTHETIC APERTURE RADAR PROCESSOR FOR IMAGING SEPARATE RANGE SWATHS Patent Application

Atul Jain, inventor (to NASA) (JPL) Filed 6 Mar. 1979 16 p (Contract NAS7-100)
(NASA-Case-NPO-14525-1; US-Patent-Appl-SN-017885) Avail: NTIS HC A02/MF A01 CSCL 17I

A method and apparatus are described for single frequency multibeam imaging of multiple strips of range swath at high range intervals for those applications where it is desirable to cover a range swath much greater than is possible for a given interpulse interval. Data from a single frequency synthetic aperture radar (in which beam parameters are adjusted so that the return from each successive swath is received during successive interpulse periods) are separated in Dopple frequency for the return from each beam at the frequency plane of the processor. Alternatively, the image formed by each beam may be spatially separated in the azimuth direction and successively selected by positioning an appropriate slit in the recording plane of the processor. NASA

N79-19196# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.

AN INVESTIGATION OF ATMOSPHERIC OPTICALLY SCATTERED NON-LINE-OF-SIGHT COMMUNICATION LINKS Final Report, 26 Sep. 1977 - 26 Sep. 1978

Warren S. Ross Oct. 1978 57 p refs
(Contract DAAG29-77-C-0048)
(AD-A062021; ARO-15365.1-A-EL) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report contains the results of a study of short-haul non-line-of-sight optical communication. The experimental facilities are discussed and include source description, receiver description, post-detection processing, and ozone measurements. Cambridge and Lubec experiments were performed. The experimental results include measurement of weather conditions, angular spreading, and non-line-of-sight data. Future research is also discussed. Author (GRA)

N79-19197# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.

DIGITAL TRANSMISSION EVALUATION PROJECT UNIVERSAL LOOP MULTIPLEXER ULM-101 Final Report, Feb. 1977 - Jul. 1978

James E. Hamant, O. P. Connell, and Henry S. Walczyk Nov. 1978 104 p
(AD-A062018; CCC-CED-78-DTEP-017) Avail: NTIS HC A06/MF A01 CSCL 17/2

Testing of the ULM-101, Universal Loop Multiplexer, was initiated to establish a data base and assessment of the Continuous Variable Slope Delta (CVSD) and log CVSD modulation techniques and to evaluate its ability to process signals typical of those used in the Defense Communications System (DCS). Tests of voice channel performance showed, in general, that minimum DCS standards were met at 32 or 64 kbps channel sampling rates. Performance was marginal and unacceptable at 16 and 8 kbps rates, respectively. Voice Intelligibility Test results are not yet available. DCEC is expected to publish these results. Use of various quasi-analog signal sources resulted in good to unacceptable performance depending on the channel sampling rate and type of signal source. Performance was not severely degraded when operating in an error environment. Author (GRA)

N79-19198# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

DEVELOPMENT OF A VOICE FUNNEL SYSTEM Quarterly Technical Report, 15 Jul. - 31 Oct. 1978

R. Rettberg Nov. 1978 32 p
(Contract MDA903-78-C-0356; ARPA Order 3653)
(AD-A061803; BBN-3972; QTR-1) Avail: NTIS HC A03/MF A01 CSCL 17/2

This quarterly technical report covers work performed during the period noted on the development of a high-speed interface, called a voice funnel, between digitized speech streams and a packet-switching communications network. Author (GRA)

N79-19199# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
OPTIMAL DISTRIBUTION ROUTING FOR VIRTUAL LINE-SWITCHED DATA NETWORKS
Adrian Segall (Technion - Israel Inst. of Tech., Haifa) Sep. 1978 41 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A061667; LIDS-P-851) Avail: NTIS HC A03/MF A01 CSCL 17/2

An algorithm that provides minimum delay routing in a data communication network using virtual line-switching is presented. The algorithm uses distributed computation in the sense that the nodes of the network update their information in an orderly fashion based on messages received from their neighbors. Receipt of these messages also trigger the various steps of the update and rerouting, so that these operations are performed in appropriate sequencing. For stationary input requirements and fixed topology the algorithm reduces network delay at each step and provides loop-free routing in the network. The method also provides an algorithm for quasi-static routing, when the input flows are slowly changing. Author (GRA)

N79-19200# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
A RECOVERABLE PROTOCOL FOR LOOP-FREE DISTRIBUTED ROUTING
A. Segall, P. M. Merlin, and R. G. Gallager Sep. 1978 30 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A061668; LIDS-P-848) Avail: NTIS HC A03/MF A01 CSCL 17/21

An algorithm for adaptive routing in data-communication networks is presented. The algorithm uses distributed computation, provides loop-free routing for each destination in the network, adapts to changes in network flows and is completely failsafe. The latter means that after arbitrary failures and additions of nodes and links, the network recovers in finite time in the sense of providing routing paths between all physically connected nodes. Proofs of all these properties are provided in a separate paper. Author (GRA)

N79-19201# State Univ. of New York at Buffalo, Amherst.
PARAMETRIC ANTENNA ANALYSIS SOFTWARE PACKAGE. VOLUME 1: APERTURE THEORY AND DESIGN TABLES Final Technical Report
Robert J. Hancock and John R. Fricke Sep. 1978 56 p refs
(Contract F30602-75-C-0122)
(AD-A061712; RADC-TR-78-147-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 09/5

At the present time many programs exist that calculate radiation patterns of particular aperture-type antenna systems or configurations. However, a new set of software is often needed for each antenna that is analyzed. The program described in this report is an effort to overcome this problem, particularly for large aperture array antenna systems. The software package described herein is capable of modeling a wide variety of antenna configurations. The key goals were speed, accuracy, versatility, and ease of use. The software described provides a tool for accurate quantitative as well as qualitative aperture antenna analysis. Although intended primarily for far-field pattern analysis of large discrete planar arrays, the package can also be used to model reflector antenna systems and optical systems. Any aperture which can be adequately modeled by an array of up to 1000 x 1000 sample points can be treated via the software package. The package has been designed to enable rapid parameter variations for various analytic purposes. Many commonly used factors, such as Taylor and Bayliss weighting functions; aperture shapes, such as rectangular, circular and elliptical, as well as randomizing and statistical weightings for either amplitude or phase characteristics are built into the program. The report briefly reviews the theory involved, the parameters available, input and output requirements. Examples to illustrate usage are provided, as is a complete User Manual for the software package. Author (GRA)

N79-19202# Mitre Corp., Bedford, Mass.
DISTRIBUTED-PROCESSING SIMULATOR Final Report
Ivan La-Garde Oct. 1978 41 p ref Sponsored by the Air Force
(AD-A061679; MTR-3584; ESD-TR-78-163) Avail: NTIS HC A03/MF A01 CSCL 17/9

During fiscal 1977, IR and D Project 9490 was established for the design and construction of a radar simulator whose system design was based on distributed-processing principles. The project scope was limited to the basic system control elements and one of the video generation modules. This document provides an overview report on the background to the project, the work accomplished, and the results obtained. Author (GRA)

N79-19203# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
AN OPTIMAL CONTROL APPROACH TO DYNAMIC ROUTING IN DATA COMMUNICATION NETWORKS. PART 1: PRINCIPLES
Franklin H. Moss and Adrian Segall Sep. 1978 80 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A061722; LIDS-P-849-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 17/2

A continuous state space model for the problem of dynamic routing in data communication networks has been recently proposed. In this paper we present an algorithm for finding the feedback solution to the associated linear optimal control problem with linear state and control variable inequality constraints when the inputs are assumed to be constant in time. The Constructive Dynamic Programming Algorithm, as it is called, employs a combination of necessary conditions, dynamic programming and linear programming to construct a set of convex polyhedral cones which cover the admissible state space with optimal controls. Due to several complicating features which appear in the general case the algorithms are presented in a conceptual form which may serve as a framework for the development of numerical schemes for special situations. In this vein the authors present in a forthcoming paper the case of single destination network problems with all equal weightings in the cost functional. Author (GRA)

N79-19204# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
SATCOM TERMINAL EHF/UHF TEST PROGRAM SYSTEM RELIABILITY ANALYSIS Final Report, Jan. 1976 - Nov. 1977
Herbert M. Bartman Apr. 1978 131 p refs
(AD-A061840; AFAL-TR-78-45) Avail: NTIS HC A07/MF A01 CSCL 17/2

This technical report presents the results of an analysis of the operational reliability for the EHF/UHF SATCOM System flight test program conducted by the Air Force Avionics Laboratory during the period of January 1976 to November 1977. The report was prepared as a case study covering a relevant literature review in such areas as reliability analysis models, methods to increase reliability, and SATCOM system reliability estimates. In addition, the study covered the data acquisition approach and data analysis results based on the reliability data obtained from the test program. Supporting appendixes covered such areas as the approach to estimating MTBF and the procedure for the calculation of the Confidence Interval as related to the MTBF. Author (GRA)

N79-19205# Naval Ocean Systems Center, San Diego, Calif.
NOSC WIDEBAND VHF WHIP ANTENNA Research and Development Technical Report, Mar. - Sep. 1978
D. M. Dilley 26 Sep. 1978 33 p
(AD-A061911; NOSC/TR-299) Avail: NTIS HC A03/MF A01 CSCL 09/5

This document presents an account of the development of a wideband VHF whip antenna 6 feet long and having a base mount compatible with AS-1729 antennas. Integrated compensation in the antenna radiating element provides a 3:1 or better standing wave ratio over most of the 30-76 MHz band. A dozen prototype antennas were delivered for field testing. In preliminary field tests, the performance of the new VHF antenna equaled or exceeded that of the AS-1729 and RC-292 antennas. Tests are continuing at Camp Pendleton, CA. Author (GRA)

N79-19206# Orincon Corp., La Jolla, Calif.
MULTIPLE COHERENCE AS A DETECTION STATISTIC

Technical Report, Jan. - Apr. 1978
R. D. Trueblood and D. L. Alspach 1 Jul. 1978 62 p refs (Contract N00123-76-C-0505; ARPA Order 3074)
(AD-A061929; NOSC/TR-265) Avail: NTIS HC A01/MF A01 CSCL 09/3

In this report, a sample statistic for the pairwise and multiple magnitude-squared coherence is investigated. The concept of coherence and its relationship to signal to noise ratios is discussed. The distribution of a sample statistic conditioned on the true coherence of the signals is given and plotted for various values of true coherence, degrees of freedom and number of time series. These distributions are used to produce receiver operating characteristic curves and plots of probability of detection versus the coherence for fixed values of false alarm.
Author (GRA)

N79-19207# Polytechnic Inst. of New York, Farmingdale.
RAYS AND MODES ON CONCAVE SURFACES Final Report, 1 Jun. 1975 - 31 May 1978
Leopold B. Felsen 16 Nov. 1978 90 p refs
(Grant DAHC04-75-G-0152)
(AD-A061885; ARO-13126.30-EL) Avail: NTIS HC A05/MF A01 CSCL 20/14

The objective of the research program has been to gain an understanding of the electromagnetic propagation and diffraction properties of concave surfaces having radii of curvature large compared to the wavelength, with application to ground wave propagation, large reflector antennas, and mutually coupled conformal antenna arrays. This basic objective has been accomplished. When the program was initiated, there was only incomplete and non-conclusive information available on how the radiation, diffraction and guiding of fields is affected by a nearby large-radius concave surface. It was recognized that neither a geometrical optics nor a whispering gallery mode representation is satisfactory for description of the field, and that a mixture of rays and modes, or a more complicated formulation involving a canonical integral analogous to the Fock integral for convex surfaces, may be the most effective. However, the foundations for these conjectures were lacking; accurate criteria for the appropriate combination of rays and modes were not at hand, nor were comprehensive numerical comparisons to assess the utility and quality of various field representations. Missing also were tractable results for the case when the observation point approaches the source or when the radius of curvature of a circular contour tends to infinity (infinite plane limit). This work has succeeded in establishing a sound analytical basis for any of the above-mentioned field formulations. Author (GRA)

N79-19208# Aerospace Corp., El Segundo, Calif. Engneering Science Operations.
TRANSFORM IMAGE CODING Final Report, 1 Apr. - 30 Nov. 1977
Andrew G. Tescher May 1978 111 p refs
(Contract F04701-77-C-0078)
(AD-A061656; TR-0078(3478-30)-1; SAMSO-TR-78-127)
Avail: NTIS HC A06/MF A01 CSCL 09/4

In recent years, considerable research effort has been done to optimize various digital communication channels. The significant growth of both commercial and military communication systems has emphasized the need for efficient data compression procedures. In the case of image transmission, the requirement is particularly demanding because of the significant amount of information to be transmitted. In this report, image compression procedures based on transform techniques are reviewed. The emphasis is on adaptive and, especially, on rate adaptive algorithms. The discussion includes an historical review, theoretical development, and illustrative examples of the transform image coding field. Author (GRA)

N79-19209# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
A SPEED-RATE INTELLIGIBILITY/COMPREHENSIBILITY THRESHOLD FOR SPEEDED AND TIME-COMPRESSED CONNECTED SPEECH
Henry J. Dehaan Jun. 1978 29 p refs
(DA Proj. 2T1-61101-A-91B)
(AD-A061172; ARI-TP-297) Avail: NTIS HC A03/MF A01 CSCL 05/10

The speech rapidity threshold is a new method for determining the maximum rate of speech understood by individual listeners. It involves repeated judgments of the comprehensibility of speech as the rate of speech varies. The purpose of the present experiment was to determine the relationship of the speech rapidity threshold to the intelligibility and comprehension of speech. To accomplish this, two experiments were conducted. The first experiment compared two types of speech reportedly different in intelligibility, simple speeded speech and compressed speech. Thresholds for compressed speech were significantly higher than those for speeded speech, an indication that the threshold at the very least reflects intelligibility. The second experiment correlated threshold values with traditional comprehension test scores. In general, correlations were low, an indication that the method is not a measure of comprehension. Results were interpreted to mean that the threshold reflects an intermediate level of information processing involving the perception of the potential for interpretation or comprehension rather than the complete act of comprehension per se. Author (GRA)

N79-19210# Naval Research Lab., Washington, D. C.
SURVEILLANCE RADAR DETECTION (SURDET) PROGRAM, REVISION NO. 11
G. V. Trunk 8 Dec. 1978 14 p refs Revised
(AD-A061945; NRL-MR-3896-Rev-1) Avail: NTIS HC A02/MF A01 CSCL 17/9

The Surveillance Radar Detection (SURDET) model is a user-oriented computer model that produces target detections and position estimates for each radar scan. The model employs a variety of target trajectories and environments including jamming, multipath propagation, and rain and sea clutter. The model is a Monte-Carlo simulation, and the automatic detector is simulated on a pulse-to-pulse basis that takes into account target suppression and resolution effects in a dense target environment. This version documents the inclusion of an M out of N detector, a doppler processor, and monopulse capability of estimating the azimuth and elevation angles of the target. Author (GRA)

N79-19211# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
SOLVING THE CURRENT ELEMENT PROBLEM OVER LOSSY HALF-SPACE WITHOUT SOMMERFELD INTEGRATIONS Interim Technical Report
R. Mittra, P. Parhami, and Y. Rahmat-Samii Oct. 1978 26 p refs
(Grant DAAG29-77-G-0111)
(AD-A062071; UIEM-78-14; UILU-ENG-78-2556; ARO-14686.1-EL) Avail: NTIS HC A03/MF A01 CSCL 20/14

In this paper a new approach is presented for efficient computation of the vector potentials arising in the problem of a current element radiating over a lossy half-space. The present approach departs from the conventional ones in that it works primarily with the transform domain representations rather than with the Sommerfeld integrals which are the corresponding spatial domain counterparts. The key step in the present method is to approximate the transforms using a suitable approximation which is valid for a wide range of parameters of practical interest. The approximated transforms can be inverted in a closed form for the horizontal component of the vector potentials (Pi sub x), and can be expressed in a computationally efficient form for the vertical component (Pi sub z). Numerical results illustrating the accuracy of the method are presented in the paper and some estimates of comparative computational times also are included. Author (GRA)

N79-19212# ENSCO, Inc., Springfield, Va. Earth Sciences and Systems Div.
MULTIPLE BOREHOLE RADAR. VOLUME 1: SUBSURFACE SITE INVESTIGATION BY RADAR, PHASE 3 Final Report
L. A. Rubin, J. C. Fowler, and G. G. Marino 30 Jun. 1978 108 p refs Sponsored in part by the Federal Highway Administration, Washington, D. C.
(Grant NSF APR-76-0330)
(PB-288073/0; NSF/RA-780149) Avail: NTIS HC A06/MF A01 CSCL 13B

Phase 2 is part of a projected 5-phase program to develop new techniques for subsurface site investigation by remote

sensors in boreholes and tunnels. The objective of the overall program is to evaluate the benefits of advanced computer-based geophysical methods, as supplements to other pre-excavation site investigation methods. This grant covered the development and initial field evaluation of a short pulse electromagnetic borehole radar system. The borehole antenna(s) can acquire data from either a single or a crosshole mode. Single-hole measurements are obtained by a transmit-receiver antenna, whereas cross-hole data is acquired with a transmitter and receiver in separate holes. The principal energy of the radar antenna is in the range of from 50 MHz to 150 MHz. The borehole radar system was field evaluated at two sites in rock. One test site featured an array of four subvertical boreholes on a line about 15' to 50' apart and about 250' deep. The measured geologic profile was of weathered to unweathered quartz mica schist to gneiss. Both single and cross-hole measurements were correlated to the core data. At the other test site three close spaced (8' to 20') subhorizontal holes were drilled to a depth of 100'. Here a detailed geologic map of the rock volume included was developed. The rock mass was an unweathered diabase. Field measurement results are strongly correlated to specific known rock structures. GRA

N79-19213# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
FIXED-SATELLITE AND BROADCASTING-SATELLITE SERVICE CONSIDERATIONS FOR 1979 GWARC PLANNING
Hiroshi Akima, Peter M. McManamon, and P. I. Wells Oct. 1978 101 p
(PB-288795/8; NTIA/SP-78/2) Avail: NTIS HC A06/MF A01 CSCL 17B

Technical and economic aspects related to the fixed-satellite and broadcasting-satellite services are discussed. Planning studies in support of the 1979 General World Administrative Radio Conference (GWARC) are presented for the frequency range of 2500 MHz to 14.5 GHz. Spectrum sharing concepts, economic (including market) factors, hybrid sateilites, and orbit-spectrum ulilization factors are reviewed. GRA

N79-19214# Middleton (David), New York.
STATISTICAL-PHYSICAL MODELS OF MAN-MADE AND NATURAL RADIO NOISE. PART 4: DETERMINATION OF THE FIRST-ORDER PARAMETERS OF CLASS A AND B INTERFERENCE
David Middleton Sep. 1978 59 p refs
(Contract COM-OT-0124)
(PB-288467/4; NTIA/CR-78/2) Avail: NTIS HC A04/MF A01 CSCL 17B

Methods of determining the first-order parameters of both the approximate and exact class A and B noise models are derived, for both the ideal case of infinite sample data and the practical cases of finite data samples. It is shown that all (first-order) parameters of these models can, in principle, be obtained, exactly or approximately, from the ideal or practical measurements. (All first-order parameters of Class A but only the (first-order) even moments of the Class B models are exactly obtainable in the ideal case.) Procedures for establishing meaningful measures of the accuracy of the parameter estimates in the practical cases are identified: suitably adjusted, nonparametric, small-sample tests of 'goodness-of-fit' (such as Kolmogorov-Smirnov tests) provide the principal techniques for establishing accuracy, at an appropriately selected significance level. The roles of robustness and stability of the parameters and their estimators are also discussed. GRA

N79-19048*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN COMMAND SYSTEM MARK 3-78
H. C. Thorman *In its* The Deep Space Network 15 Feb. 1979 p 11-18 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N79-19049*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN GROUND COMMUNICATIONS FACILITY
R. H. Evans *In its* The Deep Space Network 15 Feb. 1979 p 19-28 (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N79-19053*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPARISON OF PHASE MODULATION SYSTEMS
J. L. Massey *In its* The Deep Space Network Feb. 1979 p 57-63 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N79-19054*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUBMICROSECOND COMPARISON OF INTERCONTINENTAL CLOCK SYNCHRONIZATION BY VLBI AND THE NTS SATELLITE
W. J. Hurd, S. C. Wardrip, J. Bussion (Naval Research Lab., Washington, D. C.), J. Oaks (Naval Research Lab., Washington, D. C.), T. McCaskill (Naval Research Lab., Washington, D. C.), H. Warren (Bendix Field Engineering Corp.), and G. Whitworth (Applied Physics Lab., Johns Hopkins Univ., Baltimore) *In its* The Deep Space Network 15 Feb. 1979 p 64-69 refs Prepared in part by NASA Goddard Space Flight Center. (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N79-19055*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CODING FOR OPTICAL CHANNELS
L. D. Baumert (Arizona State Univ.), R. J. McEliece (Illinois Univ.), and H. Rumsey, Jr. *In its* The Deep Space Network 15 Feb. 1979 p 70-77 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N79-19058*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO FREQUENCY CARRIER ARRAYING FOR NEAR MAXIMUM CARRIER SIGNAL-TO-NOISE RATIO IMPROVEMENT
M. H. Brockman *In its* The Deep Space Network 15 Feb. 1979 p 99-106 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N79-19601*# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
RADAR OBSERVATION OF KNOWN AND UNKNOWN CLEAR ECHOES
Kenneth M. Glover and Thomas G. Konrad (Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.) *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 113-130 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 17I

N79-19602*# Royal Signals and Radar Establishment, Malvern (England). Radar Unit.
QUANTITATIVE ANALYSIS OF RADAR RETURNS FROM INSECTS
J. R. Riley *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 131-158 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 17I

N79-19603*# Department of Agriculture, Phoenix, Ariz. Western Cotton Research Lab.
RADAR PROGRAM AT WESTERN COTTON RESEARCH LABORATORY
Wayne Wolf *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 159-160 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 17I

N79-19604*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
THE NASA RADAR ENTOMOLOGY PROGRAM AT WALLOPS FLIGHT CENTER
Charles R. Vaughn *In its* Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 161-169 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 17I

N79-19646# Army Avionics Research and Development Activity, Fort Monmouth, N. J.
A SURVEY OF COMMUNICATIONS IN THE HIGH NOISE ENVIRONMENT OF ARMY AIRCRAFT

Mitchell S. Mayer and Arthur W. Lindberg *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 18 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19647# Royal Aircraft Establishment, Farnborough (England). Human Engineering Div.
SOME ASPECTS OF HELICOPTER COMMUNICATIONS
G. M. Rood and E. J. Lovesey *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-19215 Maryland Univ., College Park.
THE ANALYSIS OF AMPLITUDE INTERFEROMETRY DATA AND THE TESTING OF THE INTENSIFIED CHARGE COUPLED DEVICE Ph.D. Thesis
Robert Howard Braunstein 1978 230 p
Avail: Univ. Microfilms Order No. 7906652

The analysis for the last four years of data single aperture amplitude interferometer plus a recap of the previous results are described. In total the diameters of 19 stars are presented. Where any of these stars have been observed by other techniques, the diameters are compared and shown to be in fairly good agreement, with the exception of alpha Her A. The next big jump in Amplitude Interferometry involves measuring the visibilities of many pairs of apertures simultaneously. In order to do this a single photon counting array detector has to be developed. This is the intensified charge coupled device (ICCD). The use of the ICCDs to build a multi-aperture instrument is described, as is the use of siderostats to lengthen the useful baseline. The potential application of these new instruments is explored, and the future possibility of combining many long baselines into an aperture synthesis array is mentioned. Dissert. Abstr.

N79-19216 Stanford Univ., Calif.
DEVICE MODELING FOR STATISTICAL CIRCUIT SIMULATION Ph.D. Thesis
Dileep Achyut Divekar 1978 152 p
Avail: Univ. Microfilms Order No. 7905845

Statistical circuit simulation is studied with an emphasis on bipolar junction transistors. A device model suitable for this purpose is reviewed with emphasis directed toward automated measurement. An algorithm for model parameter extraction is described and measured and simulated results are compared. A statistical sample of area-scaled transistors across a wafer is characterized. Correlations between model parameters for this sample are studied. A statistical data reduction technique is reviewed with the help of a simple example. This procedure is used to explain the variation in measured data in terms of only a few parameters. This result is used to simulate the scatter of measured parameters taking into account their interrelationships. A circuit simulator is developed to perform statistical simulation of electronic circuits. A simple emitter-coupled logic gate is used as an example. Dissert. Abstr.

N79-19217 Wisconsin Univ. - Madison.
TRAVELING WAVE AMPLIFICATION IN DISTRIBUTED IMPATT DIODES Ph.D. Thesis
Michael Franz 1978 133 p
Avail: Univ. Microfilms Order No. 7823062

The current work incorporates the IMPATT mechanism into the traveling wave model and considers the actual carrier field interaction. The resulting propagation constant as a function of frequency and bias current density is documented. The diode as an oscillator is discussed together with the oscillation and frequency conditions. A 3-section quarterwave transformer is suggested to provide the impedance step between the low diode impedance and the external 50 omega circuit. A perturbational estimate of the wave losses in the substrate and the p + or - layer indicates that the substrate thickness must not exceed one skin depth in order to keep the losses small with respect to the gain. An approximate equivalent transmission line model is found whose shunt admittance is equal to the distributed admittance of a discrete diode. Dissert. Abstr.

N79-19218 North Carolina State Univ. at Raleigh.
OPTIMUM SAMPLING AND QUANTIZING FOR MULTIPLE CHANNEL DATA COMPRESSION SYSTEMS Ph.D. Thesis
Lawrence Eugene Hooker 1978 306 p
Avail: Univ. Microfilms Order No. 7905490

A solution is presented to the problem of jointly optimizing the sampling rate and the quantizer precision used to represent an electrical signal in a multiple channel compression system. In such a system the objective is to represent the message of each input channel as accurately as possible at some destination. The input channels are assumed to be equally important, and signal fidelity is measured in terms of mean squared error, unless noted otherwise. A macroscopic approach to system resource allocation is used in which each input channel is assigned transmission capacity based only upon the total number of channels requesting service. The overall conclusion is that the technique of jointly optimizing the sampling rate and the quantizer precision is quite useful in high compression ratio systems. The performance of the optimum compression algorithms is considerably better than that of conventional bit dropping systems. Dissert. Abstr.

N79-19219 Duke Univ., Durham, N. C.
DIGITAL SIMULATION OF BANDLIMITED AND NARROW-BAND RANDOM SYSTEMS Ph.D. Thesis
Young Kyun Kim 1978 144 p
Avail: Univ. Microfilms Order No. 7905360

Efficient and statistically accurate algorithms are found and compared for the numerical solution of system states equations, when the forcing functions are random, bandlimited or narrow-band Gaussian signals. Two specific applications considered involve simplified nonlinear models of ocean systems; namely, a deep-sea platform and a moored ship. Random inputs permit the use of statistical error criteria. Dissert. Abstr.

N79-19220 Clemson Univ., S.C.
ELECTRICAL TRANSPORT STUDIES OF AMMONIUM-CHLORIDE AND AMMONIUM-BROMIDE Ph.D. Thesis
Barney Edsel Taylor 1978 136 p
Avail: Univ. Microfilms Order No. 7902058

Conductivity measurements, both ac and dc, were performed on pure, Pb(++) doped and Cd(++) doped NH4Br samples. The activation enthalpy was found to be 1.14 eV and the dc Arrhenius plots were linear over the temperature range 20 C to 135 C. The ac Arrhenius plots exhibited a plateau at low temperatures, which was ascribed to a proton loss peak. Similar measurements were performed on nominally pure and two different levels of Cd(++) doped NH4Cl samples. The behavior was identical to that of NH4Br and an activation enthalpy of 1.26 eV was obtained over the range 40 C to 165 C. None of the samples exhibited an extrinsic region in the temperature range studied. Charge displacement peaks were observed in NH4Br at about 307 K with an activation enthalpy of 1.1 eV. No ITC peaks could be found over the temperature range 80 K to 340 K. Dissert. Abstr.

N79-19221 Missouri Univ. - Columbia.
OPTIMAL CONTROL OF VARIABLE FREQUENCY INDUCTION MOTOR DRIVE Ph.D. Thesis
Michael MyungJoong Youn 1978 186 p
Avail: Univ. Microfilms Order No. 7903951

The well known d-q transformation is used for transforming the motor equations to simpler relations and state variable representations are formulated. The PWM inverter output voltage waveforms for a variable frequency induction motor are investigated using the method of multiple reference frames. The

use of four pulses per each half cycle together with a small filter is proposed as a most practical solution. It is found that the torque is primarily produced by the fundamental component and the steady harmonic torque is so small that it can be neglected. Optimum voltage and frequency for an induction motor at a given speed and torque demand are analyzed using the state function of Pontryagin. In this steady state analysis, it is shown that an overexcited machine produces less energy loss than with a constant volts per hertz radio input. An open loop optimal control for an electric vehicle application is accomplished using the state function of Pontryagin. Dissert. Abstr.

N79-19222 Wisconsin Univ. - Madison.
ANALYSIS AND SYNTHESIS OF NETWORKS CONTAINING LINEARLY VARIABLE ELEMENTS Ph.D. Thesis
Greogory Michael Wierzba 1978 155 p
Avail: Univ. Microfilms Order No. 7820656

By considering fixed passive elements and linearly variable elements, a set of fundamental passive electrical network elements (F-elements) is defined. It is shown that any network consisting of only F-elements has a driving point immittance, D(s,x), that is positive real for s complex, x real and positive real for x complex, s real. Conditions on the variable coefficients, degree, and location of zeros and poles of D9s,x) are established. Conditions on the set of two-port parameters for networks containing only F-elements are also established. A method of testing whether D(s,x) is positive real for one complex and one real variable is developed. Synthesis techniques are given for the realization of any one element kind driving point function or set of two-part parameters. An application of linearly variable elements is in the modeling of certain configurations of voltage multipliers and digitally controlled switches as F-elements.
Dissert. Abstr.

N79-19223*# Martin Marietta Corp., Denver, Colo.
HIGH-VOLTAGE dc POWER PROCESSING THERMAL CONTROL AND PACKAGING TECHNIQUES Final Report
John J. Chapter and William T. Perreault Feb. 1979 110 p
(Contract NAS8-33078)
(NASA-CR-161169; MCR-79-520) Avail: NTIS HC A06/MF A01 CSCL 09C

The power processor operates in several modes, delivering up to 100 amperes of regulated electrical power, operating at input voltages to 375 volts with outputs controlled by an integral microprocessor. Several alternative packaging concepts are discussed and evaluated. High-voltage design applications, power stage interconnection and EMI considerations are also discussed. Preliminary thermal analyses were performed and the results presented for each conceptual approach with parametric study results given for the selected concept. L.S.

N79-19224# Liverpool Univ. (England). Dept. of Electrical Engineering and Electronics.
HIGH CURRENT ARCS IN AN ORIFICE FLOW. SPECTROSCOPIC MEASUREMENTS UNDER QUASI STEADY STATE CONDITIONS
C. Housby-Smith and J. E. Jenkins Mar. 1978 47 p refs
(ULAP-T-54) Avail: NTIS HC A03/MF A01

Spectroscopic measurements are reported for arcs in an orifice air flow sustained by a triangular current pulse (rise time 1.3ms, decay times greater than or equal to 5ms) with peak current values of 3 and 8kA. The air flow was generated by upstream pressures of 3.5, 6.9, 10.9, and 13.3 bars. Results were obtained with four different upstream cathode materials - carbon, copper, mild steel and elkonite (copper-tungsten mixture) - both upstream and downstream of the orifice throat. The spectroscopic records were obtained using a Hilger medium spectrograph with quartz optics. Short time exposures of about 34 microns were obtained by means of a rotating shutter. Radial profiles of electron temperature and density were derived using both copper and nitrogen lines. The arcing conditions investigated correspond to those used in previous experiments of other arc properties. Temperature values determined have already been used in establishing a theoretical model for the gas blast arc using a boundary layer integral analysis. J.M.S.

N79-19225# Liverpool Univ. (England). Dept. of Electrical Engineering and Electronics.
FLOW COMPUTATIONS FOR THE NEAR UPSTREAM ELECTRODE REGION OF A GAS BLAST CIRCUIT BREAKER
P. J. Shayler and M. T. C. Fang Feb. 1978 36 p refs
(ULAP-T-55) Avail: NTIS HC A03/MF A01

A numerical method for incompressible, axisymmetric flow computations was used to investigate flows through passages typical of those in gas blast circuit breakers near the upstream electrode. Flow separation from the electrode is allowed for when the point of separation is known. Compressibility is approximated to make comparisons with experimental results, and the agreement shows an improvement over the one dimensional flow calculation. The influence of the nozzle on flow over the shoulder of the electrode and on the point of flow separation appears to be an important factor in the performance of a circuit breaker. F.O.S.

N79-19226# Princeton Univ., N. J. Information Sciences and Systems Lab.
LINEAR RECURSIVE STATE ESTIMATORS UNDER UNCERTAIN OBSERVATIONS Technical Report, Oct. 1977 - Jun. 1978
M. Hadudu and S. C. Schwartz Jun. 1978 28 p refs
(Contract N00014-77-C-0644)
(AD-A061908; TR-42; TR-2) Avail: NTIS HC A03/MF A01 CSCL 09/3

For linear systems with uncertain observations, the existence of recursive least squares state estimators is investigated. Consideration is given to uncertain observations resulting from a binary switching sequence gamma sub k, which is specified by a conditional probability distribution and which enters the observation equation as z sub k gamma sub k H sub k; if they are not met, as for the example when gamma sub k is Markovian, no linear recursive structure can be found. On the other band, if the sequence gamma sub k is independent identically distributed, then these conditions are satisfied and a linear recursive filter exists. J.M.S.

N79-19227# Emergency Electric Power Administration, Washington, D. C.
FEASIBILITY OF ISOLATING VULNERABLE EQUIPMENT OF THE ELECTRIC POWER SYSTEM FROM SOURCES OF EMP Final Report
E. K. Stanek Mar. 1978 102 p refs
(Contract DCPA01-76-C-0290)
(AD-A061742) Avail: NTIS HC A06/MF A01 CSCL 09/3

This report evaluates the feasibility of isolating vulnerable equipment of the electric power system from sources of electro-magnetic pulses (EMP) through the use of supervisory control and dispatched personnel to perform remote and manual switching, respectively, in distribution substations. The data contained in this report were obtained primarily through interviews of electric utility personnel. The conclusion drawn from these data is that it is possible to isolate a significant portion of the vulnerable equipment in the distribution system from sources of EMP. This would not only reduce the number of failures of equipment in the distribution system (and hence system faults), but would also configure the system in a more secure state with respect to electromechanical stability. Problems associated with the transition from the normal system state to the new operating state and the restoration of service to loads after the attach are discussed. The report also contains information on the development of a new lightning arrester design that has better EMP characteristics than existing designs. Author (GRA)

N79-19228# Texas Univ. at Austin. Dept. of Chemistry.
SEMICONDUCTOR ELECTRODES. 19: AN INVESTIGATION OF S/Se SUBSTITUTION IN SINGLE CRYSTAL Cd Se AND Cd S PHOTOELECTRODES BY ELECTRON SPECTROSCOPY Technical Report, 1 Jan. - 31 Dec. 1978
Rommel N. Noufi, Paul A. Kohl, James W. Rogers, Jr., John M. White, and Allen J. Bard 1 Nov. 1978 28 p refs
(Contract N00014-75-C-0922)
(AD-A061747; TR-7) Avail: NTIS HC A03/MF A01 CSCL 09/1

Photoelectron spectroscopy studies verify the occurrence of S/Se substitution in single crystal CdSe and CdS photoanodes when used in photoelectrochemical cells containing S2- or Se2- solutions. A possible mechanism of the S/Se exchange is

discussed as well as its consequences on the electrode stability and the output parameters of the photoelectrochemical cells.
Author (GRA)

N79-19229# TRW Defense and Space Systems Group, Redondo Beach, Calif.
MONOLITHIC MICROWAVE PREAMPLIFIER Technical Report 1 Sep. 1977 - 31 Mar. 1978
D. Claxton, R. Kaelberer, and A. Benavides Sep. 1978 56 p refs
(Contract N00014-77-C-0645)
(AD-A061728) Avail: NTIS HC A04/MF A01 CSCL 09/5

A computer model of the FET has been developed based on the Pucel model, but with several improvements incorporated. The model has been exercised to produce FET designs, which will be optimized for low noise amplifier performance. The model also predicts device sensitivity to the processing variables, and provides S parameters as a function of frequency and bias. The model has been used to design devices for a low noise monolithic X-band preamplifier. Author (GRA)

N79-19230# Texas Instruments, Inc., Dallas.
IC FABRICATION USING ELECTRON-BEAM TECHNOLOGY Quarterly Report, 1 Mar. - 1 Jun. 1978
Gilbert L. Varnell, John L. Bartelt, Robert A. Owens, Jack Reynolds, Roger A. Robbins, and Claude D. Winborn Aug. 1978 20 p refs
(Contract DAAB07-76-C-8105)
(AD-A061721; TI-03-78-32; QR-7) Avail: NTIS HC A02/MF A01 CSCL 09/5

A New positive electron resist (TI-313) has been implemented for fabrication of 256-bit bipolar RAMs. This TI-313 resist has allowed plasma etching at each oxide removal step in the process. The pinhole data on this resist after oxide etch is comparable with that measured on the best standard negative photoresists. Previous attempts at fabricating the 256-bit bipolar RAMs have failed due to the high number of defects in the oxide caused by an inherent problem with PBS electron resist during wet etching. In addition, a change was made from the double-level metal 256-bit bipolar RAM (54S300) to the single-level metal 256-bit bipolar RAM (74S301A). This change was made because the TI-Houston production facility was achieving extremely low yields on the 54S200/300 and had discontinued production. These changes have allowed fabrication of functional devices during this quarter. Author (GRA)

N79-19231# Edgerton, Germeshausen and Grier, Inc., Salem, Mass.
REPETITIVE SERIES INTERRUPTER 2 Interim Technical Report, 1 Feb. - 31 May 1978
Robert F. Caristi and David V. Turnquist Oct. 1978 96 p
(Contract DAAB07-76-C-1301)
(AD-A062007; DELET-TR-76-1301-8; ITR-8) Avail: NTIS HC A05/MF A01 CSCL 09/1

Work has continued under the RSI II Program with the emphasis of the research effort being placed on restrike elimination, an investigation of the nature and effects of both the steady-state and instantaneous tube drops, the design, fabrication and testing of the first member of a family of 50 kV interrupters, a theoretical and experimental study of the effects of self-interruption and interruption time, and an investigation of RSI triggering characteristics including the effects of keep-alive discharges. Restrike was substantially eliminated. Forward tube drops of the order of two percent of the peak forward operating voltage of the RSI were demonstrated as being reasonable, and have in fact been achieved in practice. GRA

N79-19232# Texas Instruments, Inc., Dallas. Central Research Labs.
X-BAND SOLID STATE MODULE Final Report, 30 Sep. 1976 - 30 Apr. 1978
W. R. Wisseman, F. H. Doerbeck, H. M. Macksey, E. C. Secrest, V. Sokolov, and H. Q. Tserng Oct. 1978 137 p refs
(Contract N00173-76-C-0384)
(AD-A062069; TI-08-77-48-F) Avail: NTIS HC A07/MF A01 CSCL 09/5

This report describes an eighteen-month program to develop an X-band solid state amplifier. The amplifier is the critical component of an all solid state tranceiver module for use in active element, airborne, phased array radars. The performance goals were an output power of 4 W (min.) with 25 dB gain over the 9 to 10 GHz frequency band with an efficiency = or–20% under pulsed conditions. Two approaches were pursued to meet these goals: an all GaAs FET amplifier and an FET/Read diode hybrid amplifier. At the completion of the program, two amplifiers of each type were delivered. An all FET amplifier module with a three-stage driver and a balanced output stage delivered an output power of 4W with 24 dB gain over the 8.9 to 9.9 GHz frequency band (l dB) with 20% efficiency including bias circuit losses. An FET/Read diode hybrid amplifier delivered 5W over with 25 dB gain at 9.5 GHz over a 600 MHz bandwidth with l9% efficiency. Extensive cw and pulsed measurements indicate that the all FET amplifier is best suited for phased array radar applications. Author (GRA)

N79-19233# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
A NOTE ON COVARIANCE-INVARIANT DIGITAL FILTER DESIGN AND AUTOREGRESSIVE MOVING AVERAGE SPECTRUM ANALYSIS
John F. Kinkel (Consultant, Newport Beach, Calif.), Joseph Perl (Tadiran, Holon, Israel), Louis L. Scharf, and Allen R. Stubberud (Calif. Univ., Irvine) Nov. 1978 15 p refs
(Contract N00014-75-C-0518)
(AD-A061916; TR-22(ONR)) Avail: NTIS HC A02/MF A01 CSCL 09/3

Consider an autoregressive-moving average (ARMA) discrete-time sequence (x sub k) with covariance sequence (R sub k). The results are derived and presented somewhat differently than usual to complement the results for the synthesis of covariance-invariant digital filters. In the context of spectrum analysis, the results provide a means of performing ARMA spectrum analysis on data that arise as sampled data from a rational continuous-time process. An important result, shows that the ARMA spectrum can be obtained without actually solving the nonlinear factorization problem for the MA coefficients. GRA

N79-19234# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
CONTACTLESS MEASUREMENT OF CARRIER GENERATION RATE IN SEMICONDUCTORS
P. Das, R. T. Webster, and H. Estrada-Vazquez 21 May 1978 17 p refs
(Contract N00014-75-C-0772; Grant AF-AFOSR-3426-77)
(AD-A061655; MA-ONR-20) Avail: NTIS HC A02/MF A01 CSCL 20/12

A new measurement technique for determining the mobile charge carrier generation rate in the vicinity of a semiconductor surface is proposed. The technique uses a surface acoustic wave (SAW) propagating on the surface of a piezoelectric substrate to probe the surface of the semiconductor sample placed adjacent to it. The SAW attenuation in response to a transverse voltage pulse applied across the semiconductor by means of field plates provides the needed information; hence no electrical contacts are required on the semiconductor. Data is presented using this technique for a silicon/lithium niobate combination. This contactless measurement can provide a rapid method of determining the effect of specific wafer processing steps on dark current levels which limit the performance of semiconductor memory and imager arrays. Author (GRA)

N79-19235# TRW Defense and Space Systems Group, Redondo Beach, Calif.
THE 9438 HIGH LEVEL TRAVELING WAVE TUBE AMPLIFIER ANOMALY, VOLUME 1 Final Report
J. A. Durschinger 11 Aug. 1978 180 p
(Contract F04701-75-C-0257)
(AD-A062051; TRW-28600-AR-015-01-Vol-1; SAMSO-TR-77-184-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 09/1

The results of an investigation into orbit failures of HLTWTA on DSCS-II satellite are presented along with recommendation for corrections on future TWTAs to be issued on DSCS-II. The possible causes of these failures are examined in light of orbit data, and laboratory simulation testing. Author (GRA)

N79-19236# TRW Defense and Space Systems Group, Redondo Beach, Calif.
THE 9438 HIGH LEVEL TRAVELING WAVE TUBE AMPLIFIER ANOMALY, VOLUME 2, REVISION A Final Report
J. A. Durschinger 11 Aug. 1978 666 p refs Revised
(Contract F04701-75-C-0257)
(AD-A062052; TRW-28600-AR-015-01-Vol-2; SAMSO-TR-77-184-Vol-2-Rev-A) Avail: NTIS HC A99/MF A01 CSCL 09/1

Contents: F7 and F8 Test and Orbit Telemetry Parameters, Previous HLTWTA Failure Analysis Reports, Data Package Comments and Failure/Destroy Summaries, Test Plans, Procedures and Reports, and DSCS TWTA Review Group. GRA

N79-19237# National Bureau of Standards, Washington, D. C. Building Thermal and Service Systems Div.
AN EXPLORATORY STUDY OF DIELECTRIC BREAKDOWN VOLTAGES FOR RESIDENTIAL WRITING Final Report
Jose Eduardo V. Raduan (Instituto de Pesquisas Tecnologicas), Robert W. Beausoliel, and William J. Meese Oct. 1978 35 p refs Sponsored in part by HUD
(PB-288857/6; NBSIR-78-1537) Avail: NTIS HC A03/MF A01 CSCL 09A

Residential electric circuits are subjected to surge voltages resulting from load switching in buildings, and from external causes such as lightning. Laboratory test data are presented on high voltage breakdown values for armored cable (type AC cable), nonmetallic-sheated cable (type NM), flat conductor cable, and duplex receptacles. Dielectric withstand voltage test requirements in current standards for residential wiring devices vary over a wide range. In some cases, the standard test voltage values for both wiring and wiring devices are less than surge voltages recorded on wiring in residences. Also, field-recorded voltage wave forms and rates of their application are different from those used in standard withstand voltage tests. GRA

N79-19238# National Bureau of Standards, Washington, D. C. Electron Devices Div.
AN ASSESSMENT OF HIGH POWER THYRISTOR TECHNOLOGY Final Report
Robert I. Scace Oct. 1978 42 p refs
(Contract DOEEA-77-A-01-6010)
(PB-288730/5; NBSIR-78-1559) Avail: NTIS HC A03/MF A01 CSCL 09A

The current state of the technology for designing and making high-power thyristors is reviewed. The discussion is confined primarily to thyristors having voltage ratings of 2000 V or greater, and current ratings above a few hundred amperes. Particular attention is given to the factors which limit the performance of such devices. GRA

N79-19019*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LIGHTNING TESTS OF THE ORBITER PYROTECHNIC ESCAPE SYSTEM
R. Cohen and E. H. Schulte (McDonnell Aircraft Co., St. Louis, Mo.) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 85-103 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 09C

N79-19037*# Okress (Ernest C.), Philadelphia, Pa.
THE PHYSICS OF GRIDDED AND CONDUCTIVE COATED DIELECTRICS FOR SPACECRAFT
E. C. Okress *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 345-364 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 09C

N79-19061*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATIC FILAMENT WARM-UP CONTROLLER
J. McCluskey and J. Daeges *In its* The Deep Space Network 15 Feb. 1979 p 132-133 (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 09A

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N79-19239 California Inst. of Tech., Pasadena.
ANALYSIS OF HEAT TRANSFER IN SEVERAL MEDIA Ph.D. Thesis
Satwinder Singh Sadhal 1979 142 p
Avail: Univ. Microfilms Order No. 7906215

Analytical solutions to three heat transfer problems, each involving more than one medium, are obtained by using some exact and approximate methods. For the analysis of nucleate boiling at a solid surface, a single bubble is simulated by a point source (or a sink) of liquid. A solution of the boundary layer type is obtained for a constant point sink, and it is used to estimate the microlayer thickness, a quantity useful in determining some features of latent heat transfer due to vapor flow within the bubble. The thermal effects of droplets condensing on, or evaporating from, a solid surface are analyzed by solving the steady heat-conduction equation for a spherical segment droplet on a semi-infinite solid with suitable boundary and interface conditions. Estimates of long-time thermal contact resistances are obtained. Dissert. Abstr.

N79-19240 Johns Hopkins Univ., Baltimore, Md.
A STUDY ON DISPERSIVE WAVES IN INHOMOGENEOUS MEDIA Ph.D. Thesis
Robert Gyorgy Egri 1979 133 p
Avail: Univ. Microfilms Order No. 7906448

A systematic procedure for solving the Whitham equation in a two-layer fluid of finite depth is developed. An analytic solution which asymptotically evolves into exactly two solitons is exhibited. The solution of the shallow water case of Korteweg and deVries is obtained as a limit of the present theory. Hammer's method for cutoff modes is described for inhomogeneously filled waveguides. The method is shown to be very efficient in calculations of dispersion characteristics. Convergence is proved and numerical performance is discussed for single and coupled image lines. The method of cutoff modes is also applied to propagation problems in elastic waveguides. Dissert. Abstr.

N79-19241 Purdue Univ., Lafayette, Ind.
FORCED CONVECTION IN A TWO-DIMENSIONAL NOMINALLY STEADY TURBULENT BOUNDARY LAYER Ph.D. Thesis
Gilbert Gregory Weigand 1978 456 p
Avail: Univ. Microfilms Order No. 7905793

The problem of forced convection of heat in a two-dimensional turbulent boundary layer is considered. The asymptotic structure of the time-mean equations in the limit of large Reynolds number is determined using the method of matched asymptotic expansions without recourse to any specific turbulence closure model. The temperature boundary layer is a double composite layer and the Reynolds number dependence is established for the leading order velocity, temperature and length scales in each layer. Composite uniformly valid profiles for the velocity and the temperature are derived from leading order inner and outer layer asymptotic expansions for the velocity and temperature. Dissert. Abstr.

N79-19242 California Univ., Berkeley.
EXPERIMENTAL AND THEORETICAL STUDIES IN CONVECTIVE TRANSPORT Ph.D. Thesis
Jyh-tong Teng 1978 83 p
Avail: Univ. Microfilms Order No. 7904626

Theoretical studies were carried out for the convective transport to rotating bodies. In addition, theoretical and experimental results are presented for the turbulent transport in non-Newtonian pipe flow. The turbulent flow about a rotating cylinder which rotates with respect to its own axis in an otherwise quiescent fluid is studied. Velocity and temperature distributions are obtained for this condition by solving the corresponding conservation equations. The flow about rotating rods and blades which rotate with a moment arm in the direction of the axis of

symmetry was also studied. For these rotating bodies the heat or mass transfer has been determined. A calculations procedure based on a local cross-flow concept is used and compared with the experimental data available. The flows around these rotating bodies are quite complex and further work is recommended.
Dissert. Abstr.

N79-19243 Purdue Univ., Lafayette, Ind.
AN ANALYSIS AND PREDICTION OF NOMINALLY STEADY, TWO-DIMENSIONAL, CONSTANT-PROPERTY TURBULENT BOUNDARY LAYERS Ph.D. Thesis
Richard Kent Scharnhorst 1978 392 p
Avail: Univ. Microfilms Order No. 7905773

The structure of the timemean flow for large Reynolds number is discussed using the method of matched asymptotic expansions and without resorting to a specific closure relation. In the limit of large Reynolds number, the turbulent boundary layer is a composite double layer consisting of an inner and outer region; leading order differential equations as well as the Reynolds-number dependence of the velocity and length scales are determined for each layer. In order to avoid the classical closure problem for the wall layer, an analysis of the time-dependent flow in the wall layer is carried out. Further verification of the unsteady wall-layer model is carried out by forming a composite profile for the entire boundary layer using the law of the wake as an outer-layer profile. An alternate model for the outer layer is obtained by considering the conditions necessary for equilibrium. A boundary-layer prediction scheme is developed based upon the full numerical solution of the leading order outer region equation. Dissert. Abstr.

N79-19244 Wisconsin Univ. - Madison.
AN INTERFEROMETRIC STUDY OF NATURAL CONVECTION HEAT TRANSFER IN FLAT-PLATE AND VEE-CORRUGATED ENCLOSURES Ph.D. Thesis
Kenneth Royal Randall, Jr. 1978 315 p
Avail: Univ. Microfilms Order No. 7822268

The flat plate enclosure was bounded by an isothermal, cooled surface on top and a hot surface below. The vee-corrugated enclosure consisted of a cooled flat surface on top and a vee-corrugated heated surface below. The effects of Grashof number, tilt angle, and enclosure aspect ratio (the ratio of enclosure length to plate spacing) on both the local and average heat transfer coefficients were determined for the flat plate enclosure. The Grashof number range tested was 3000 to 310,000 and the aspect ratio varied between 9 and 36. The angles of tilt of the enclosure with respect to the horizontal were 45, 60, 75, and 90 degrees. Correlations were developed for both local and average Nusselt number over the range of test variables. The effect of tilt angle was found to reduce the average heat of transfer by about 18 percent from the value at 45 degrees to that at 90 degrees. No significant effect of aspect ratio over the range tested was found. Dissert. Abstr.

N79-19245 Minnesota Univ., Minneapolis.
THERMODYNAMICS AND STABILITY OF NON-NEWTONIAN FLUIDS Ph.D. Thesis
Kumbakonam Ramamani Rajagopal 1978 132 p
Avail: Univ. Microfilms Order No. 7906367

The restrictions placed on the constitutive relations for a general incompressible Rivlin-Ericksen fluid on complexity n due to the Clausius-Duhem inequality and the principle of frame indifference are studied. On making an assumption that the free energy density is smallest when the fluid is locally at rest, and in addition that the specific heat of the fluid is positive, results are obtained regarding the boundedness and uniqueness of fluids complexity n. Next, restricting attention to fluids of grade 3, which form a special subclass of fluid of complexit 3, restrictions on the material moduli due to the Clausius-Duhem inequality and the assumption that, (A1) the free energy is a minimum in equilibrium are obtained. Dissert. Abstr.

N79-19246 Princeton Univ., N. J.
UNSTEADY THEORY OF DROPLET VAPORIZATION WITH LARGE GAS AND LIQUID REYNOLDS NUMBERS Ph.D. Thesis
Satya Prakash 1978 194 p
Avail: Univ. Microfilms Order No. 7905640

Using a boundary layer analysis for the gas phase and modelling the quasi-steady liquid phase motion, droplet vaporization is studied with unsteady droplet heating. Through this analysis it is shown that the droplet vaporization is essentially unsteady for most of its lifetime, particularly so for the heavier, less volatile fuels. Also the droplet heating is unsteady and the droplet temperature becomes uniform only towards the end of its lifetime. The implications of the unsteady vaporization are outlined. Simplification and applicability of the present analysis to the more general situation of spray vaporization, taking into account the unsteady effects, is suggested for future work. Dissert. Abstr.

N79-19247 Cincinnati Univ., Ohio.
INVESTIGATION OF THREE-DIMENSIONAL VISCOUS FLOW IN DUCTS WITH ARBITRARILY VARYING CROSS-SECTIONS USING SURFACE-ORIENTED COORDINATE SYSTEM Ph.D. Thesis
Kurabalakota Sathyanarayana 1978 174 p
Avail: Univ. Microfilms Order No. 7904767

The laminar flow in ducts of arbitrarily varying rectangular or polar cross sections were analyzed for an incompressible viscous fluid. The geometry is represented in terms of surface-oriented coordinates determined by a numerical transformation. Accordingly, these coordinates are obtained as solutions of Poisson equations in the physical domain, with Dirichlet boundary conditions. Even the coordinate-transformation equations are solved in the transformed domain so as to allow the use of a uniform computational grid. For this purpose, the role of the dependent and the independent variables is interchanged and the inverted-transformation equations are then solved using an alternating-direction implicit (ADI) numerical method. The coordinates so generated are not necessarily orthogonal. Only radially invariant geometries were considered. Dissert. Abstr.

N79-19248 California Inst. of Tech., Pasadena.
THE GENERAL DYNAMIC EQUATION FOR AEROSOLS Ph.D. Thesis
Freddy Morris Gelbard 1979 263 p
Avail: Univ. Microfilms Order No. 7906209

The conservation equations for a spatially homogeneous aerosol are developed and solved. In developing the basic equations, a new form of the conservation equations or General Dynamic Equation (GDE), termed the discrete-continuous GDE, was developed. Particle growth rates limited by gas phase diffusion, surface, and volume reactions are discussed. Numerical techniques and their errors associated with the numerical solutions are discussed in detail. Techniques for simulating a sulfuric acid and water aerosol are presented. An exact solution to the continuous form of the GDE for a multicomponent aerosol for simplified cases is developed. Dissert. Abstr.

N79-19249 Johns Hopkins Univ., Baltimore, Md.
THE DYNAMICS OF BREAKING SURFACE WAVES Ph.D. Thesis
James Henry Duncan 1978 128 p
Avail: Univ. Microfilms Order No. 7906445

Some aspects of the dynamics of breaking surface waves are studied by a theoretical and experimental examination of two-dimensional, quasi-steady, breaking waves produced by towing an airfoil below the water surface. The theory that is developed shows that the thickness divided by the length of the breaking region (aspect ratio) should be a constant for all of the experimental conditions, that the wake thickness should grow like distance behind the wave to the one-half power, and that the vertically integrated momentum deficit in the wake should be equal to the component of the breaking region's weight which is tangent to the wave's forward face. The experiments show a number of interesting results: Both the length of the breaking wave and its amplitude (measured from the trough before the wave to the wave crest) are proportional to the wave speed squared. Waves with the same phase speed (and therefore, the same length and height) can have different slopes of their forward face; however, the vertical component of the length of the breaking region is always found to be proportional to the phase squared. Dissert. Abstr.

N79-19250 Maryland Univ., College Park.
THE TURBULENT BOUNDARY LAYER AT LOW REYNOLDS

NUMBER Ph.D. Thesis
Lawrence Patrick Purtell 1978 119 p
Avail: Univ. Microfilms Order No. 7906663

The turbulent boundary layer over a flat plate is investigated in air flowing at constant pressure and at low Reynolds numbers obtained by low velocities. The law-of-the-wall is evaluated directly for changes with Reynolds number by examining time-mean velocity profiles, momentum thicknesses, and velocity gradients. The coefficients in the logarithmic law are found to be independent of Reynolds number. Several tests for development of the boundary layer are discussed and compared. Measurements of the turbulence structure including streamwise intensities, spectra, and probability densities, show that proper scaling of these variables can produce similarity with Reynolds number in either the inner or outer layer. The logarithmic region as a fraction of the boundary layer is found to remain approximately constant with Reynolds number and thus should perhaps be viewed as an essential element of the turbulent boundary layer at all Reynolds numbers. Dissert. Abstr.

N79-19251 Stanford Univ., Calif.
VOLUME-FLOW MEASUREMENT USING DOPPLER ULTRASOUND: A UNIFIED APPROACH Ph.D. Thesis
Charles Fred Hottinger 1978 243 p
Avail: Univ. Microfilms Order No. 7905876

Three new configurations, utilizing pulsed Doppler ultrasound, are proposed for the measurement of flow through an arbitrary sample surface. hese techniques produce a volume-flow estimate independent of Doppler angle, vessel size, and velocity profile. Two of the methods rely on Doppler imaging to determine the area of the lumen projection on the sample surface. The estimate of flow is then based on the product of this projected area multiplied by the area-average velocity normal to this surface. The third method eliminates explicit measurement of this projected area by recognizing that such information is contained in the backscattered Doppler power from a uniformly illuminated sample surface. An experimental system based on this principle is described, and test results demonstrate measurement of volume flow independent of Doppler angle, vessel size, and velocity profile. Dissert. Abstr.

N79-19252 California Univ., Berkeley.
NUMERICAL ANALYSIS OF FLOW FIELDS GENERATED BY ACCELERATING FLAMES Ph.D. Thesis
John Kurylo 1978 291 p
Avail: Univ. Microfilms Order No. 7904510

A numerical technique for the analysis of nonsteady flow fields generated by accelerating flames in gaseous media is presented. Of particular interest in the study is the evaluation of the nonsteady effects on the flow field and the possible transition of the combustion process to detonation caused by an abrupt change in the burning speed of an initially steady flame propagating in an unconfined combustible gas mixture. Optically recorded observations of acclerating flames established that the flow field can be considered to consist of nonsteady flow fields associated with an assembly of interacting shock waves, contact discontinuities, deflagration and detonation fronts. Dissert. Abstr.

N79-19253 Illinois Inst. of Tech., Chicago.
DROP-INTERFACE COALESCENCE: EFFECTS OF INTERFACIAL PROPERTIES Ph.D. Thesis
Nader Aderangi 1978 189 p
Avail: Univ. Microfilms Order No. 7902986

Stability of single oil droplets at a liquid-liquid interface in the presence of surfactants was investigated. For the systems studied, the coalescence time of oil droplets correlated favorably with interfacial viscosity of the system. Small amounts of polyvinyl alcohol (PVA) in the water phase were used to obtain finite interfacial shear viscosities in the water-ethylbenzene system. This increase in shear viscosity was accompanied by a large increase in the lifetime of ethylbenzene droplets at the oil-water interface. The increased stability was attributed to the steric hindrance of the adsorbed polymer layer. A second surface active agent composed of oleic acid, caustic soda, and sodium chloride was added to the system to obtain low interfacial tensions. It was found that addition of this surfactant further enhanced coalescence rates and decreased interfacial shear viscosities. This was explained as resulting from the dislodging of the adsorbed PVA layer by the latter surfactant. It was found that both coalescence time and interfacial viscosity were strong functions of the concentration of oleic acid. Dissert. Abstr.

N79-19254 Lehigh Univ., Bethlehem, Pa.
THE OSCILLATING TURBULENT BOUNDARY LAYER IN A CONICAL DIFFUSER Ph.D. Thesis
Michael Edward Tomsho 1978 281 p
Avail: Univ. Microfilms Order No. 7904322

The turbulent boundary layer in a conical diffuser, with the inlet airflow oscillating sinusoidally, was studied experimentally and theoretically. The diffuser inlet diameter is 100 mm and the flow is characterized by an entrance Reynolds number on the order of 120000. The 3-degree (half-angle) diffuser flow is in the turbulent regime throughout the test section, and no separation occurs. Oscillation frequencies span the range of 5-30 Hz with amplitudes approximately 10 percent of the time-averaged velocities. Mappings of the oscillatory response were made by a hot wire anemometer, and the signals were processed on-line by a laboratory computer to obtain the phase average of the unsteady velocity field. The equations for the oscillatory component were derived and solved numerically. The oscillatory Reynolds shear stresses are modeled. Dissert. Abstr.

N79-19255 Nebraska Univ. - Lincoln.
AN INVESTIGATION OF THE HEAT TRANSFER MECHANISMS AROUND HORIZONTAL BARE AND FINNED HEAT EXCHANGE TUBES SUBMERGED IN AN AIR FLUIDIZED BED OF UNIFORMLY SIZED PARTICLES Ph.D. Thesis
Wayne Burwin Krause 1978 160 p
Avail: Univ. Microfilms Order No. 7901936

A primary objective was to show a close relation of the experimental convective heat transfer coefficient with the convective heat transfer coefficient determined from theoretical models. The finned tube configurations were considered an extension of the bare tube to enhance heat transfer. The heat transfer coefficients were computed from the heated tube temperature, the bed temperature, and the electrical heat input. Fluid mechanics characteristics, such as residence times of bubbles and emulsion activity, were found by utilizing a fast response capacitance probe with solid-state electronic circuitry. Dissert. Abstr.

N79-19256 Northwestern Univ., Evanston, Ill.
NONLINEAR CRITICAL LAYERS Ph.D. Thesis
Charles Conrad Groth 1978 184 p
Avail: Univ. Microfilms Order No. 7903272

Existing linear and nonlinear theories of the critical layer are explained, and their domain of validity bounded by topological and dynamical considerations. A theory of the steady critical layer flow is presented, which gives the schedule by which the momentum flux (phase change) for the critical layer diminishes as the Reynolds number increases. This theory agrees with the findings of others in showing viscosity to be important near the boundary of the closed streamline region. The resulting fine viscous structure is explored by the use of self similarity and special approximations for diffusion near the stagnation points. Analytical solution of simple boundary value problems, and computer calculations, indicate that the suggested flow structure can develop after the sudden introduction of waviness into a wall which bounds as initially parallel flow. Dissert. Abstr.

N79-19257 California Univ., Berkeley.
A STUDY OF DIFFERENCING SCHEMES FOR ELLIPTIC-TYPE CONVECTION EQUATIONS Ph.D. Thesis
Louis Chik-Man Chow 1978 97 p
Avail: Univ. Microfilms Order No. 7904408

A comparative study on four existing finite-difference schemes as applied to the steady-state convection equation was made. It was found that the more commonly used central difference and upwind-difference schemes are not as efficient as the exponential-difference scheme and the Allen-Southwell scheme. A fourth-order difference scheme was developed for the Laplace equation. For a few test problems, this scheme is shown indeed to be highly accurate compared to the central-difference scheme. The approach of the exponential-difference scheme is taken and extended to give a higher-order difference scheme for the steady-state convection equation. A major difficulty encountered is the

imposition of the boundary condition. As a result, this scheme is expected to be very accurate only when the boundary conditions are explicitly given. Dissert. Abstr.

N79-19258 California Univ., Berkeley.
EXPERIMENTAL STUDY OF WALL SHEAR RATES IN THE ENTRY REGION OF A CURVED TUBE Ph.D. Thesis
Ung So Choi 1978 126 p
Avail: Univ. Microfilms Order No. 7904407

Local wall shear rates in steady and pulsatile flows in the entry region of a curved tube were measured by the limiting current method. The experimental wall shear distributions show a valley in the circumferential wall shear profile and a region of nonmonotonic variation of the average wall shear rates with downstream distance, both of which are prominent features of the entry flow in a curved tube. The existence of the valley suggests a vortex structure with several pairs of vortices in a developing curved tube flow in contrast with one pair in a fully developed flow. Pulsatile flow experiments show that the distributions of wall shear rates will not be significantly influenced by pulsatility. It is also shown that the amplitudes of the flow and of the wall shear variations decrease with frequency and that the wall shear is nearly in phase with the average flow. Dissert. Abstr.

N79-19259 Oklahoma State Univ., Stillwater.
DYNAMIC ANALYSIS OF A MONOSTABLE FLUID AMPLIFIER Ph.D. Thesis
Hyo Whan Chang 1978 204 p
Avail: Univ. Microfilms Order No. 7903651

A steady-state jet reattachment model is developed which can predict the reattachment position of a two-dimensional turbulent jet to an offset, inclined wall in the presence of a control flow. The value of a jet spread parameter is established for this model based on the measurement of the jet centerline axial velocity and correlation of analytically predicted jet reattachment distance with experimental data. The steady-state reattachment model, along with a description of the principal dynamic processes involved, forms the basis for the development of an analytical dynamic model for a monostable fluid amplifier. The study was limited to a monostable amplifier with a single control input, straight walls, and a sharp splitter. Dissert. Abstr.

N79-19260 Illinois Inst. of Tech., Chicago.
GRID GENERATED TURBULENCE WITH AND WITHOUT ROTATION ABOUT THE STREAMWISE DIRECTION Ph.D. Thesis
Roald Arnold Wigeland 1978 326 p
Avail: Univ. Microfilms Order No. 7903000

Grid-generated turbulence of several scales and intensities was experimentally studied in the presence and absence of different rates of rotation about the direction of the mean flow. The influence of rotation on the turbulence was indicated by changes in the turbulent energy, its distribution among the velocity components, and its characteristic scales. In addition, the dominant physical process which caused the effects of the rotation was established. Comparison of the present results with earlier experiments using newly discovered parameters resolved their contradictory conclusions and made all of the experiments consistent with each other, though disproving earlier suggested theories. Dissert. Abstr.

N79-19261 Illinois Inst. of Tech., Chicago.
FLOW OF VISCOELASTIC FLUIDS THROUGH A SUDDEN CONTRACTION Ph.D. Thesis
Jahanshah Mansoori 1978 152 p
Avail: Univ. Microfilms Order No. 7902983

The results of a theoretical study of the creeping flow of a viscoelastic fluid through a sudden tubular contraction are presented. The governing system of equations consists of the vorticity transport equation, the stream function equation, and the rheological constitutive equation. The time dependent partial differential equations are transformed into algebraic equations by finite difference methods and the steady state solution is obtained through iterative methods for a range of fluid elasticity and apparent shear rates. A new method of solution is developed in which the constitutive equation is treated independently of the equations of motion so that the scheme can be easily modified for a variety of constitutive equations. Two rheological equations which are reasonable representations of viscoelastic fluids are considered. Dissert. Abstr.

N79-19262 Oklahoma State Univ., Stillwater.
FLUID FLOW AND HEAT TRANSFER IN U-BENDS Ph.D. Thesis
Mahmood Moshfeghian 1978 203 p
Avail: Univ. Microfilms Order No. 7903711

The effect of a 180 degree bend on heat transfer to a single phase fluid in tubes is obtained. Experiments were made with water, Dowtherm G, and ethylene glycol flowing through an electrical-resistance-heated tube. The emphasis was to explore the effect of secondary flow on heat transfer and the variation of local tube-to-fluid heat transfer coefficient in the U-bend and downstream from it. Heat transfer coefficients were obtained around the periphery of the tube which should be useful in understanding the mechanism of the flow. The study covered Reynolds numbers from 55 to 31,000 and Prandt numbers from 4 to 270. Four different bends were studied. The bend radius to tube inside radius ratios ranged from 4.84 to 25.62. Dissert. Abstr.

N79-19263 California Univ., Berkeley.
LONGITUDINAL WAVES IN TUBES CONTAINING STATIONARY AND STREAMING LIQUIDS Ph.D. Thesis
Freidoon Barez 1978 224 p
Avail: Univ. Microfilms Order No. 7904371

An analytical and experimental study of the wave effects produced by axisymmetric impact on a circular cylindrical elastic and/or viscoelastic tube filled with either stationary or streaming compressible, viscous liquid was performed. The governing equations of motion of the liquid based on a linearized set of Navier-Stokes equations are coupled with those of the tube according to the membrane-shell theory. The predictions of the pulse propagating in the tube material give reasonable agreement in comparison with the experimental results. Attenuation and dispersion of the longitudinal waves propagating in the tube are found to be principally due to the viscoelastic behavior of the acrylic plastic. Utilization of such constitutive behavior in Skalak's extension of Joukowsky's theory and neglecting the radial inertia of the tube would predict the major propagation featues of the pulses. Dissert. Abstr.

N79-19264# Oak Ridge National Lab., Tenn. Engineering Technology Div.
EXPERIMENTAL DATA FOR AMMONIA CONDENSATION ON VERTICAL AND INCLINED FLUTED TUBES
S. K. Combs Jan. 1979 61 p refs
(Contract W-7405-eng-26)
(ORNL-5488) Avail: NTIS HC A04/MF A01

Heat transfer experiments were run to evaluate the performance of single fluted tubes with ammonia condensing on the outside. Data are presented for tubes of 2.54-cm nominal diameter and 1.2 m in length including: (1) tests with a vertical fluted tube with seven equally spaced drainage skirts - effective condensing length of 0.15 m (0.5 ft); (2) tests with both a smooth and a fluted tube inclined 30 deg off vertical; and (3) tests with a doubly fluted tube. The results for the tube with drainage skirts show that for ammonia there was no advantage in going to shorter condensing lengths in the range of heat fluxes tested. For the inclined tests, the film condensation coefficients for the smooth tube were more than doubled over results for a vertical smooth tube; whereas, for the inclined fluted tube, the heat transfer performance was slightly lower than for a vertical orientation. Overall heat transfer coefficients are presented for the doubly fluted tube over a range of water velocities and heat loads. J.M.S.

N79-19265# Tel-Aviv Univ. (Israel). Dept. of Applied Mathematics.
FINITE ELEMENTS FOR FLUIDYNAMICS. VARIATIONAL FORMULATIONS AND CALCULATIONS FOR BOUNDARY-INITIAL-VALUE PROBLEMS Final Scientific Report, Jul. 1976 - Jul. 1977
Nima Geffen, Sara Yaniu, and Levi Lustman Jul. 1977 173 p refs
(Grant AF-AFOSR-2561-73)

Avail: NTIS HC A08/MF A01

Quasilinear systems of partial differential equations with initial and boundary values are treated via an equivalent variational formulation. Finite elements with linear and bilinear approximations are described and calculations done for heat transfer, wave propagation and transonic flow problems. A variational principle for three-dimensional systems with arbitrary constraints in which the vector Lagrange multiplier has a clear physical meaning is presented and applied to additional problems of transonic flow and anisotropic wave propagation. Further numerical tests and simulations are reported. Multidimensional hyperbolic systems are treated by a semi-analytic method yielding the location and time where shocks appear in initially smooth flows. Application to water waves, gas shocks and plasmadynamics are described in detail. Author

N79-19266*# Virginia Polytechnic Inst. and State Univ., Blacksburg. College of Engineering.

NONLINEAR INTERACTION OF WAVES IN BOUNDARY-LAYER FLOWS

Ali H. Nayfeh and Ali N. Bozatli Feb. 1979 31 p refs (Grant NsG-1255; NR Proj. 061-201) (NASA-CR-158239; VPI-E-79-6) Avail: NTIS HC A03/MF A01 CSCL 20D

First-order nonlinear interactions of Tollmien-Schlichting waves of different frequencies and initial amplitudes in boundary-layer flows are analyzed by using the method of multiple scales. For the case of two waves, a strong nonlinear interaction exists if one of the frequencies w2 is twice the other frequency w1. Numerical results for flow past a flat plate show that this interaction mechanism is strongly destabilizing even in regions where either the fundamental or its harmonic is damped in the absence of the interaction. For the case of three waves, a strong nonlinear interaction exists when w3 = w2- w1. This combination resonance causes the amplitude of the wave with the difference frequency w3 to multiply many times in magnitude in a short distance even if it is damped in the absence of the interaction. The initial amplitudes play a dominant role in determining the changes in the amplitudes of the waves in both of these mechanisms. Author

N79-19267# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

AERODYNAMIC SEPARATION OF GASES AND ISOTOPES

1976 280 p refs Lecture held at Rhode Saint Genese, Belgium 5-9 Jan. 1976 (VKI-Lecture-Series-82) Avail: NTIS HC A13/MF A01

A lecture series is presented which has the objective to describe the fundamental aspects of certain promising aerodynamic separation schemes, to present an up-to-date review of the status of each, and to contrast the techniques from both the technical and economic points of view. For individual titles, see N79-19268 through N79-19278.

N79-19268# University of Southern California, Los Angeles.

AERODYNAMIC SEPARATION OF GASES AND ISOTOPES: INTRODUCTION

E. P. Muntz *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 12 p refs (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

Brief descriptions are given for the following aerodynamic techniques used in the separation of gases and isotopes: (1) the separation nozzle; (2) the opposing jet scheme; (3) the separation probe scheme; (4) the jet membrane device; (5) the crossed-beam device; and (6) expansion induced or velocity slip separation. G.Y.

N79-19269# University of Southern California, Los Angeles.

THEORY OF SEPARATION PROCESSES

E. P. Muntz *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 31 p (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

In this brief outline of the theory of separation processes only those aspects of the theory are considered that are necessary for an understanding of the role played by the several process variables. Sufficient material is presented so that the aerodynamic separation schemes may be placed in reasonable perspective relative to other techniques. There are several different approaches that can be taken in the development of separation process theory. The established theory has its simplest form when applied to close separations where there is a relatively gradual enrichment. Also consider, where appropriate, are rapid enrichments, such as might be encountered in aerodynamic separation of nonisotopic systems or possibly in the laser absorption or molecular beam scattering schemes. G.Y.

N79-19270# Drexel Univ., Philadelphia, Pa.

RELEVANT ASPECTS OF GAS DYNAMICS AND KINETIC THEORY

B. B. Hamel *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 29 p (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

Basic collisional parameters are defined for gas mixtures with roughly equal masses and for mixtures in which the components have disparate masses. In a gas mixture of equal masses the situation is reasonably clear. Collision frequencies, mean free paths and collision times may be defined unambiguously and a collision between molecules and its subsequent effect are fairly clear. The main complication is the effect of a strong nonequilibrium distribution function. In a gas mixture of disparate masses the very concept of a collision becomes difficult. The effects of encounters between heavy and light molecules produce very different effects in each gas, and the standard definitions are inadequate. A framework is developed for discussing collisional effects in disparate mixtures. G.Y.

N79-19271# University of Southern California, Los Angeles.

GASEOUS DIFFUSION AND THE CENTRIFUGE

E. P. Muntz *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 16 p refs (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

Gaseous diffusion and the gas centrifuge are briefly discussed. An example of a possible commercial application of an aerodynamic separation scheme is also given. G.Y.

N79-19272# Kernforschungszentrum, Karlsruhe (West Germany).

THE SEPARATION NOZZLE PROCESS

W. Ehrfeld *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 33 p refs (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

The separation nozzle process for the enrichment of the light uranium isotope U-235 was developed as an alternative to the gaseous diffusion and centrifuge processes. It utilizes the mass dependence of the centrifugal force in a fast curved flow of gaseous UF6 to effect a separation of the uranium isotope. Compared to the other processes for uranium isotope separation the nozzle process is superior by the fact that it combines a reliable and comparatively simple technology with a highly development potential. Topics discussed include: (1) basic principles of the separation nozzle method; (2) flow and diffusion phenomena; (3) studies on advanced separation nozzle systems; (4) the technology of the separation nozzle process; and (5) economics and optimization of the separation nozzle process. G.Y.

N79-19273# Commissariat a l'Energie Atomique, Saclay (France).

THE SEPARATION PROBE

R. Campargue *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 25 p refs (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

The separation probe utilizes the bow shock wave and/or the pressure gradient induced by a probe operating in a supersonic stream. The gas removed from the probe stagnation region and collected from the sampling orifice, is enriched in the heavier species. Although the emphasis is on the physics of the separation effect, other relevant problem areas, including economics, are also mentioned and discussed. From experimental and even theoretical works on gas and isotope mixtures, the following points are analyzed: physical principles; optimization

of single probes and probe arrays; influence expansion ratio, pressure recovery, flow velocity, and rarefaction. G.Y.

N79-19274# Drexel Univ., Philadelphia, Pa.
THE JET MEMBRANE: UPSTREAM SAMPLING
B. B. Hamel and E. P. Muntz (Univ. of Southern Calif., Los Angeles) *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 20 p refs (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

Notes taken from a portion of a paper presented at the First European Nuclear Symposium, April 1975, are presented. Topics discussed in this lecture include: the high pressure limit of the jet membrane; experiment and results for the jet membrane; and preliminary comparison of a jet membrane separation to mass diffusion and gaseous diffusion. G.Y.

N79-19275# Commissariat a l'Energie Atomique, Saclay (France).
THE JET MEMBRANE-EXPERIMENT: DOWNSTREAM SAMPLING
R. Campargue *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 30 p refs (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

The invasion separation effect of the free jet structure was found in 1966. In the Downstream Sampling Configuration the light fraction is withdrawn from the supersonic central core, by skimming the separating free jet. From experimental and theoretical results obtained for gas and isotopic mixtures, the following points linked to operation and equipment costs, are considered : system description; influence of mass ratio, expansion ratio, nature of separating gas, ratio of upflow to separating jet flow, rarefaction. From an uninteresting aspect of the Jet Membrane (elimination of background penetration), a new principle was discovered to produce nozzle beams which may be of great interest for other separation processes involving free jets and/or molecular beams. Author

N79-19276# Kernforschungszentrum, Karlsruhe (West Germany).
EXPANSION: INDUCED SEPARATION
J. Gspann *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 12 p refs (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

The process is based on the fact that in a nozzle expansion of a mixture of light carrier gas with a small amount of heavy seed gas, the heavy molecules are not accelerated to full equilibrium speed if the expansion takes place under rarefied conditions. The expected separation factors and the corresponding estimates of energy consumption are explained. The required properties of the velocity selector is analyzed. The results of earlier studies on time-of-flight separation of isotopes in molecular beams formed by molecular effusion are reviewed. G.Y.

N79-19277# Kernforschungszentrum, Karlsruhe (West Germany).
THE CROSSED JET METHOD
J. Gspann *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 15 p refs (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

The method is based on the gradual deflection of the heavy molecular beam particles by multiple collisions with the lighter molecules of intersecting free jets. The angular separation of beam particles of different masses or collision cross sections is used to obtain fractions of different composition by suitable placing of sharp-edged blades or probes. The separation is limited on principle by the unavoidable randomization of the beam particle velocities due to the statistical distribution of the collision parameters. The applications of the crossed jet method and the experimental results obtained with clusters, heavy molecules, and isotopes of xenon are discussed. G.Y.

N79-19278# Battelle Inst., Frankfurt am Main (West Germany).
LASER: BASED SEPARATION TECHNIQUES
H. Jetter *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes 1976 22 p refs (For primary document see N79-19267 10-34)
Avail: NTIS HC A13/MF A01

The optical separation techniques select the desired isotopes and by exciting them strongly change their physical or chemical behavior. By a suitable process it is therefore possible to remove very efficiently the excited isotopes from the mixtures. The following topics are discussed: (1) basic principles of isotopic selective excitation; (2) separation by beam deflection; (3) separation by two-step-photoionization; (4) isotope separation by selective chemical reaction of excited atoms and by selective ionization of molecules; and (5) isotope separation by chemical reaction of excited molecules. G.Y.

N79-19279# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO RHEOLOGY
1976 220 p refs Lecture held at Rhode Saint Genese, Belgium, 16-20 Feb. 1976
(VKI-Lecture-Series-85) Avail: NTIS HC A10/MF A01

A brief history of the development of rheology is presented. The non-Newtonian behavior of flowing deformable matter is discussed along with the basic concepts and techniques in rheometry. For individual titles, see N79-19280 through N79-19285.

N79-19280# University Coll. of Wales, Aberystwyth. Dept. of Applied Mechanics.
RHEOLOGY AND ITS RELEVANCE TO THE WESTERN WAY OF LIFE
K. Walters *In* Von Karman Inst. for Fluid Dyn. Introduction to Rheology 1976 89 p refs (For primary document see N79-19279 10-34)
Avail: NTIS HC A10/MF A01

A nontechnical introduction to rheology is presented. Topics discussed include: flow behavior of elastic liquids, rheology in health, rheology in the oil industry, and the applications of mathematics in the development of rheology. F.O.S.

N79-19281# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
THE MECHANICS OF FLUID SUSPENSIONS
E. J. Hinch *In* Von Karman Inst. for Fluid Dyn. Introduction to Rheology 1976 25 p refs (For primary document see N79-19279 10-34)
Avail: NTIS HC A10/MF A01

The rheology of some materials is discussed in terms of its microstructure. Dilute suspensions of small particles in a Newtonian fluid are considered. The behavior of the particles in suspension at the microscopic level was studied. The following microphysical properties were examined: external dipolar fields, rotary Brownian motion, elastic particles, droplets with interfacial tension, hydrodynamic, and electrostatic interactions. The macroscopic observable rheology was related to the microscopic characterization. F.O.S.

N79-19282# Imperial Coll. of Science and Technology, London (England).
RHEOLOGICAL APPLICATIONS IN POLYMER PROCESSING
J. R. A. Pearson *In* Von Karman Inst. for Fluid Dyn. Introduction to Rheology 1976 16 p (For primary document see N79-19279 10-34)
Avail: NTIS HC A10/MF A01

The processing of crystalline and amorphous thermoplastic polymers is discussed. Extrusion flow through dies, and into molds is described along with unconfined flows including fiber spinning, film casting, film blowing, and blow molding. F.O.S.

N79-19283# Birmingham Univ. (England).
VISCOELASTIC JETS AND DRAG REDUCTION
D. R. Oliver *In* Von Karman Inst. for Fluid Dyn. Introduction to Rheology 1976 22 p refs (For primary document see N79-19279 10-34)
Avail: NTIS HC A10/MF A01

The jet flow of viscoelastic liquids emerging from a smooth, round tube in laminar flow was investigated using jet thrust techniques. Drag reduction is discussed in terms of turbulence suppression in flowing liquids using additives. F.O.S.

N79-19284# Birmingham Univ. (England).
HEAT TRANSFER AND MIXING IN RHEOLOGICALLY COMPLEX FLUIDS
D. R. Oliver *In* Von Karman Inst. for Fluid Dyn. Introduction to Rheology 1976 18 p refs (For primary document see N79-19279 10-34)
Avail: NTIS HC A10/MF A01

Laminar flow heat transfer in a tube with temperature profiles was studied. The heat transfer in laminar flow is shown to be inefficient, and the use of corrugated plates as static mixers is discussed. F.O.S.

N79-19285# Shell Research Ltd., Chester (England). Thornton Research Centre.
RHEOLOGICAL APPLICATIONS IN LUBRICATION
J. F. Hutton *In* Von Karman Inst. for Fluid Dyn. Introduction to Rheology 1976 26 p refs (For primary document see N79-19279 10-34)
Avail: NTIS HC A10/MF A01

Lubrication of interacting surfaces in relative motion to reduce friction and wear is discussed with emphasis on fluid lubricants. Temperature effects on viscosity of lubricants are described along with the rheological properties of nonpolymeric oils, polymeric oils, greases, hydrodynamic, and elastohydrodynamic lubrication. F.O.S.

N79-19286# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
GAS-SOLID SUSPENSIONS
1976 377 p refs Lecture held at Rhode Saint Genese, Belgium, 3-7 May 1976
(VKI-Lecture-Series-90) Avail: NTIS HC A17/MF A01

The lecture series began with introductory lectures on gas-solid suspensions and pneumatic conveying theory. Several lectures were devoted to fundamental aspects of gas-solid suspensions. Emphasis was given to the dynamics of single particles, the thermodynamics of gas-solid mixtures, statistical and other theoretical approaches and turbulence effects. Applied research was illustrated by lectures on flowing suspensions in ducts, nozzles and jets, including the design of dense phase pneumatic conveying systems. Several lectures were devoted to experimental techniques for measurement of flow, concentration, particle size and velocity. Included with these techniques are those which use lasers. For individual titles, see N79-19287 through N79-19299.

N79-19287# State Univ. of New York, Buffalo.
FUNDAMENTALS OF GAS-PARTICLE FLOW
George Rudinger *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 31 p (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

Lectures on the following topics are given: (1) general properties of two-phase flow; (2) dynamics of single particles; (3) thermodynamics of gas-particle mixtures; (4) steady flow through ducts; (5) waves and jets; and (6) experimental techniques. G.Y.

N79-19288# State Univ. of New York, Buffalo.
DYNAMICS OF SINGLE PARTICLES
George Rudinger *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 34 p (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

The behavior of single particles is demonstrated for several examples. Some of these are based on Stokes drag, and the resulting simplification of the analytical work is apparent. The salient features of the motion are brought out in this manner, but other forms of the drag coefficient may be necessary for more precise calculations. In general, numerical solutions must be obtained for the equations of motion, although analytical solutions sometimes may be possible by a judicious choice of the expression used to represent the drag coefficient. As an example, the penetration of a particle across a constant flow is discussed. G.Y.

N79-19289# State Univ. of New York, Buffalo.
THERMODYNAMICS OF GAS-PARTICLE MIXTURES
George Rudinger *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 20 p refs (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

Thermodynamic properties of gas-particle mixtures are derived which are useful in many calculations involving such mixtures. Some of these concepts may be used to estimate under what conditions certain simplifications are permissible. G.Y.

N79-19290# State Univ. of New York, Buffalo.
STEADY FLOW THROUGH DUCTS
George Rudinger *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 35 p (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

Various cases of gas-particle flow through nozzles are discussed. It is demonstrated that a particle volume which cannot be neglected at high loading ratios leads to major complications. Relatively simple solutions of the equations can be obtained by inverse techniques in which the particle velocity along the nozzle is prescribed. The corresponding nozzle shape then must be determined together with the other flow variables. Nozzles which the ratio of the particle velocity to the gas velocity is constant are discussed in some detail. At high practical loading, the flow can be treated as isothermal, and considerable simplifications of the analysis result. G.Y.

N79-19291# State Univ. of New York, Buffalo.
WAVES AND JETS
George Rudinger *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 39 p (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

Consider a gas-particle mixture that is in a state of steady flow. Any change of the conditions at some point then is signaled to other points by pressure waves which produce the necessary adjustment of the flow to the changed conditions. Three types of pressure waves are considered: shock waves, large-amplitude waves and sound waves. The analysis and properties of these types of waves are discussed. Penetration of a jet into a cross flow is also discussed. G.Y.

N79-19292# State Univ. of New York, Buffalo.
EXPERIMENTAL TECHNIQUES
George Rudinger *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 2 p refs (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

An outline about the more important types of equipment encountered in the field of gas-particle flow is given. Powder feeders, which are needed to produce gas-particle flows, and instrumentation to measure different variables of the flow are briefly discussed. As an illustration, experiments are described to determine the effective particle drag coefficient from observation of the relaxation zone in a shock wave. G.Y.

N79-19293# Thames Polytechnic, London (England). School of Mechanical Engineering.
INTRODUCTION TO PNEUMATIC CONVEYING
J. S. Mason *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 12 p refs (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

The types of pneumatic conveying systems and their design are briefly analyzed and discussed. It is concluded that each conveying system has its own flow characteristics which are so complex that a general solution to cover all situations is most unlikely to emerge. It should now be evident that pneumatic conveyor design will never become a science, but it has emerged from a state of the art image. G.Y.

N79-19294# Thames Polytechnic, London (England). School of Mechanical Engineering.
INTRODUCTION TO PNEUMATIC CONVEYING THEORY
J. S. Mason *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 18 p refs (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

The following topics are discussed: (1) introduction to gas solid flow theory; (2) gas-solid flow through vertical pipes; (3) gas-solid flow through horizontal pipes; (4) gas-solid flow around bends; and (5) experimental measurements. G.Y.

N79-19295# Thames Polytechnic, London (England). School of Mechanical Engineering.
DENSE PHASE PNEUMATIC CONVEYING
J. S. Mason *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 19 p refs (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

Dilute phase pneumatic conveying systems are usually characterized by low solids loading ratios, low pressure differentials and high solids velocities. The large quantity of air used in such applications generally requires large diameter ducts and large separating equipment like cyclones and bag filters at the discharge end. In addition, the high velocities can lead to problems of bend wear and undesirable particle degradation. Topics discussed in this lecture include: flow behavior, choice of systems, advantages and disadvantages of blow tank systems, and applications of blow tank systems. A flow model to predict the performance of a blow tank system is also given. G.Y.

N79-19296# Thames Polytechnic, London (England). School of Mechanical Engineering.
APPLICATION OF LASER MEASUREMENT TECHNIQUES TO THE PNEUMATIC TRANSPORT OF FINE PARTICLES
J. S. Mason *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 refs (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

The application of laser anemometry techniques to the measurement of local velocities in gas and liquid flows is now well established. The research shows that the laser anemometry is a useful and versatile tool for the measurement of velocity phenomena in a flowing gas-solid suspension. Although the technique is normally limited by solids loading ratio penetration, it can be used for particle wall velocity measurements in the densest of flows. It is evident that the anemometer could be developed to form part of a control loop in order to optimize plant performance. G.Y.

N79-19297# Bradford Univ. (England).
PARTICLE SIZE MEASUREMENT
Terence Allen *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 49 p refs (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

The problems in size analysis are outlined. The problems include: sampling, dispersion, analysis techniques, presentation of data, and evaluation of results. These problems are discussed and some of the equipment used in size analysis are described. G.Y.

N79-19298# Paris-Sud Univ., Orsay (France).
THEORETICAL APPROACHES TO GAS-SOLID SUSPENSIONS
Andre Fortier *In* Von Karman Inst. for Fluid Dyn. Gas-Solid Suspensions 1976 20 p refs (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

Flow types observed in pneumatic transport of solid materials in pipes are highly complex and it is difficult to treat these problems purely theoretically. However, it is easy to write the equations governing the motions of the dispersed solid material named in this paper as particles and of the fluid as well as the initial and boundary conditions defining a particular problem. Unfortunately, the number of variables is so high that it is only possible to develop similarity analysis showing that the number of similarity parameters is $2(N + p + 1)$, N being the total number of particles and p the number of types of possible impacts. These high number of variables gives to these flows an essentially stochastic character which allows the problem to be treated by introducing only precise physically significant statistical quantities and by using, side by side, the general equations and experimental results. G.Y.

N79-19299# Paris-Sud Univ., Orsay (France).
EXPERIMENTAL TECHNIQUES IN HIGH RATE OF LOADING PNEUMATIC CONVEYING SYSTEMS
Andre Fortier *In* Von Karman Inst for Fluid Dyn. Gas-Solid Suspensions 1976 30 p refs (For primary document see N79-19286 10-34)
Avail: NTIS HC A17/MF A01

Experimental results on pressure drop in a long horizontal pipe are given in order to show why it is important for applications to study high rate of loading flows. The application of radioactive tracers and Beta rays absorption techniques for the measurement of solid particles velocity and space concentration in a two-phase air-solid flow at high loading rates is also discussed. G.Y.

N79-19300# New York Univ., N. Y. Dept. of Applied Science.
NON-LINEAR WAVES AND QUASI-ORDERED STRUCTURES IN TURBULENCE Interim Report, 1 Jul. 1977 - 30 Jun. 1978
Roberto Vaglio-Laurin Oct. 1978 27 p refs
(Contract F49620-77-C-0119)
(AD-A062022; AFOSR-78-1481TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The research seeks a deterministic analytical model, derived from first principles without empiricism, for the development and evolution of quasi-ordered, large scale, events/structures in turbulent flows. Upon a careful analysis of recent experiments with homogeneous incompressible transitional and turbulent mixing layers, the events/structures are associated with non-linear instability waves whose behavior is dominated by self-induced effects rather than by interactions among instabilities which are resonant according to the linear dispersion relation. The non-linear transport of vorticity in the neighborhood of the critical layer is identified as the flow process responsible for the self-induced effects beginning at modest wave amplitudes A = or - .01. A mathematical model of the attendant generation of bound-wave harmonics, subharmonics and sideband frequencies in strictly two-dimensional incompressible flow subject to monochromatic disturbance input is developed by joint use of matched asymptotic expansion and stretched coordinates techniques. The predictions of the model are compared favorably with relevant experimental data for mixing layers. Model extensions required for the analysis of modulated three-dimensional non-linear disturbances in non-homogeneous compressible flows are outlined, and the role of those results in describing the evolution of quasi-ordered events/structures in practical turbulent flows is discussed. Author (GRA)

N79-19301# Naval Academy, Annapolis, Md. Michelson Physical Lab.
NUCLEATION, STABILIZATION AND GROWTH OF MICROBUBBLES IN WATER Final Report
Lawrence A. Crum 30 Oct. 1978 28 p
(AD-A061731) Avail: NTIS HC A03/MF A01 CSCL 20/4

This final report of a study of nucleation, stabilization and growth of microbubbles in water reviews the advances made and external communications originating from the author's research. GRA

N79-19302# Hydronautics, Inc., Laurel, Md.
ON THE CHANGES IN LIFT OF HYDROFOILS DUE TO SURFACE INJECTIONS OF POLYMER ADDITIVES
Abbas M. Sinnarwalla and T. R. Sundaram Feb. 1978 131 p refs
(Contract N00014-77-C-0070)
(AD-A061723; TR-7703-1) Avail: NTIS HC A07/MF A01 CSCL 13/10

Existing data on the effects on lift of symmetric hydrofoils due to the injection of polymer solutions on to their surfaces show that the lift can either decrease or increase depending on the polymer, injection velocity, location of injection, side of injection and angle of attack. A unified, albeit semiempirical, approach is suggested in the present report for correlating and explaining the apparently contradictory data. It is proposed that the observed lift changes may be due to the influence of the injections on the boundary-layer displacement effect that is known to reduce the circulation around hydrofoils. Four separate boundary-layer effects due to injection are identified and discussed, namely

those due to changes in the effective angle of attack, the effective camber, the circulation (in addition to the changes in circulation associated with the previous two effects), and the thickness distribution. Classical methods of airfoil theory are utilized to calculate the 'effective' hydrofoil shape that would have produced the observed pressure distributions. This effective shape is utilized to identify the different boundary layer effects, and these, in turn, are identical with the changes likely to be produced by polymer injections. GRA

N79-19303# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.

A STABILITY INVESTIGATION FOR AN INCOMPRESSIBLE SIMPLE FLUID WITH FADING MEMORY Interim Report

E. F. Infante and J. A. Walker (Northwestern Univ., Evanston, Ill.) Aug. 1978 29 p refs

(Contract N00014-76-C-0278; Grants AF-AFOSR-3063-76; NSF ENG-76-81570; NSF MCS-76-07247; DA-ARO-D-31-124-73-G130)

(AD-A062068; AFOSR-78-1510TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The nonlinear equations of motion for an incompressible simple fluid, occupying a fixed bounded container, are formulated on the basis of the 'finite-linear' viscoelastic theory for materials with fading memory; this formal boundary-initial value problem is then viewed as a nonlinear abstract evolution equation on a certain Hilbert space. It is shown that a linearized version of this evolution equation is associated with a linear dynamical system on this Hilbert space, and several stability and asymptotic behavior results for this linearized problem are proved through the use of Liapunov stability methods. On the assumption that the original nonlinear evolution equation also is associated with some dynamical system on the same space, it is shown that the rest condition of the fluid is stable and all motions are bounded. The Liapunov function employed for this purpose can be interpreted as a mechanical energy function for the fluid. Author (GRA)

N79-19304# Naval Ship Research and Development Center, Bethesda, Md.

ON IRROTATIONAL FLOWS EQUIVALENT TO THE BOUNDARY LAYER AND WAKE, THE FIFTH DAVID TAYLOR LECTURE

Louis Landweber Nov. 1978 49 p refs

(AD-A062002; DTNSRDC-78-111) Avail: NTIS HC A03/MF A01 CSCL 20/4

One of the simplest and most useful results of boundary-layer theory is that the flow exterior to the boundary layer, which will be assumed to be irrotational, is pushed outwards by an amount called the displacement thickness. This suggested, early in the development of boundary-layer theory, that the accuracy of a boundary-layer calculation for a body could be improved by adding the boundary-layer thickness to the body dimensions and using the predicted pressure distribution on the so-thickened body in a recalculation of the boundary layer. The irrotational field about the thickened body, including the displacement thickness of the wake, is itself of great interest, and numerous attempts have been made in this manner to calculate the effect of the boundary layer and wake on the outer irrotational flow. The concept of the thickened body gives an approximate model which is usually justified by its consistency with the approximations of thin boundary-layer theory. The basis of this model and suggested ways of refining it are reviewed. Such a development would be useful for several current problems of ship hydrodynamics, among them the determination of Betz sources in a method of calculating viscous drag by an analysis of wake survey data, and the investigation of the effect of the boundary layer and wake on wavemaking resistance. GRA

N79-19305# Air Force Academy, Colo.

THE DEVELOPMENT OF A LASER DOPPLER VELOCIMETRY SYSTEM FOR UNSTEADY SEPARATED FLOW RESEARCH: PRELIMINARY RESULTS Interim Report, Sep. 1977 - Sep. 1978

R. A. Kadlec, G. W. Sparks, Jr., and Michael S. Francis Oct. 1978 28 p refs

(AF Proj. 2307)

(AD-A061724; FJSRL-TR-78-0010) Avail: NTIS HC A03/MF A01 CSCL 20/4

Each of the six case studies documents public participation in Federal and/or state governmental decisions related to energy facility siting. Four of the cases involved decisions on specific facilities at specific sites, namely: (1) various state and federal licensing procedures for the Seabrook, New Hampshire nuclear facility; (2) the Maine Environmental Improvement Commission's denial of a permit for an oil refinery on Sears Island in Penobscot Bay; (3) the Atomic Energy Commission's amendment to the license for the Big Rock Point, Michigan nuclear reactor to allow an increased level of plutonium-enriched fuel use; (4) the AEC's review, arising from disclosure of a geological fault, of the North Anna River, Virginia, nuclear facility. A fifth case documents a series of public meetings conducted in Pennsylvania by the Governor's Energy Council to consider the energy park concept. The sixth study was a narrative history and analysis of RM-50-1, a rulemaking proceeding conducted by the AEC in 1972 and 73 on emergency core cooling system operating standards. GRA

N79-19306# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.

A WALL-FLOW-DIRECTION PROBE FOR USE IN SEPARATING AND REATTACHING FLOWS

John K. Eaton, Albert H. Jeans, Jalal Ashjaee, and James P. Johnston Nov. 1978 16 p refs

(Contract N00014-75-C-1143; Proj. SQUID)

(AD-A061901; SQUID-SU-3-PU) Avail: NTIS HC A02/MF A01 CSCL 20/4

The measurement of the exceedingly unsteady behavior of nominally two-dimensional, turbulent flows in regions of separation and reattachment is facilitated by the development of a new instrument; the wall-flow-direction probe which determines the instantaneous flow direction (upstream or downstream) in a thin layer of fluid very close to the wall. The probe was tested in low-speed, unsteady, separating and reattaching air flows. It appears to offer considerably more accuracy than other methods for the determination of the time mean separation and reattachment points. In addition, the probe and its control circuits are relatively inexpensive and easy to construct. Author (GRA)

N79-19307# Tel-Aviv Univ. (Israel). Dept. of Applied Mathematics.

FINITE ELEMENTS FOR FLUID DYNAMICS, MIXED-TYPE PROBLEMS, TRANSONIC FLOWS Interim Scientific Report, 1 Jul. 1977 - 30 Jun. 1978

Nima Geffen 1978 89 p refs

(Grant AF-AFOSR-3345-77; AF Proj. 2307)

(AD-A062066; AFOSR-78-1513TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

The report includes two parts: (1) Various finite elements formulations and discretizations for initial/boundary value problems for the Tricomi equation in the hyperbolic domain, a continuation of our work last year. (2) An attempt to extend 'hyperbolic' methods of analysis to mixed type flows with hyperbolic-elliptic shocks and ensuing entropy conditions for stable, accurate numerical schemes. GRA

N79-19308# Minnesota Univ., Minneapolis.

STUDIES IN THE VISCOMETRY OF SLOW MOTION OF RHEOLOGICALLY COMPLEX LIQUIDS Final Report, 1 Oct. 1975 - 30 Sep. 1978

D. D. Joseph and G. S. Beavers Oct. 1978 21 p refs

(Grant DAAG29-76-G-0047)

(AD-A062077; ARO-12754.16-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

This report summarizes the research accomplishments. The research has covered a broad range of problems associated with the viscometry of non-Newtonian fluids, from both analytical and experimental points of view. This report restates the objectives, reviews the major findings, and lists the abstracts of all the publications that have evolved from this research program. Author (GRA)

N79-19309# Delft Hydraulics Lab. (Netherlands).

AIR ENTRAINMENT IN SIPHONS: RESULTS OF TESTS IN TWO SCALE MODELS AND AN ATTEMPT AT EXTRAPOLATION

J. A. Casteleyn, P. vanGroen, and P. A. Kolkman Nov. 1977 10 p refs Presented at the 17th Congr. of the Intern. Assoc. for Hydraulic Res., Baden-Baden, West Ger., 15-19 Aug. 1977
(Publ-187) Avail: NTIS HC A02/MF A01

For the design of nine siphons with a cross-section of circa 3 x 3 m squared, data were required on the entrainment of air by the water during the priming stage. As no evident relation can be expressed between the corresponding values found in models and in prototypes, tests were made in two models of different scale in an attempt to obtain results that could be extrapolated with physical plausibility and that were in general agreement with the results of other investigators. Results were worked out in two ways: first, a relation q sub air = f (v sub b) was sought between air entrainment and water velocity at the point of air inclusion. Next, the proportionality q sub air: (v sub b - v sub c) cubed was investigated, wherein v sub c is an arbitrary value. Optimum proportionality was obtained with v sub c values corresponding closely with the minimum water velocity at which air entrainment was observed. L.S.

N79-19310# Delft Hydraulics Lab. (Netherlands).
GATE EDGE SUCTION AS A CAUSE OF SELF-EXCITING VERTICAL VIBRATIONS
P. A. Kolkman and A. Vrijer Nov. 1977 10 p refs Presented at the 17th Congr. of the Intern. Assoc. for Hydraulic Res., Baden-Baden, 15 - 19 Aug. 1977
(Publ-188) Avail: NTIS HC A02/MF A01

A theory of self-exciting vertical vibrations is presented which comprises the following elements: (1) gate raise variations induce discharge fluctuations, (2) discharge fluctuations and flow inertia cause local pressure difference variations across the gate opening, and (3) local pressure difference variations result in variations of the force exercised by the water on the gate; they also affect the discharge fluctuations. From this theory follows that self-excitation occurs in gates when suction forces are generated in the gate opening. The Strouhal Number (S) lies in a critical range between 0 and 0.1. The theory was tested on a gate with a lower edge having a right-angled lip. Self-exciting vertical vibrations did appear at low S values. These vibrations were recognizable by a strictly exponential increase. The critical S range turned out to be between 0.012 and 0.2; i.e. somewhat higher than predicted by theory. Maximum self-excitation was of an order that accorded with theory, but occurred in a smaller range of S values. L.S.

N79-19311# Delft Hydraulics Lab. (Netherlands).
THE CLOSURE PROBLEM FOR DEPTH-AVERAGED TWO-DIMENSIONAL FLOW
C. Flokstra Nov. 1977 12 p refs Presented at the 17th Congr. of the Intern. Assoc. for Hydraulic Res., Baden-Baden, 15-19 Aug. 1977
(Publ-190) Avail: NTIS HC A02/MF A01

Vertically integrated equations of motion contain terms, derivatives of the so called effective stresses, that have to be modeled to obtain a closed system of equations. By means of a vorticity balance, it is shown that these effective stresses allow the occurrence of circulating flows. The existence of these stresses is a necessary, but not sufficient, condition for the generation of circulating flows. These stresses consist of three contributions: viscous stresses, turbulent stresses, and stresses due to depth integration of three-dimensional advective terms. The first stress can be neglected, but the other two are important as shown by order of magnitude estimates. By the second stress energy is transferred to the circulating flows. The third stress generally shows the opposite behavior, and its importance depends on the curvature of the stream lines. Outside shear layers and regions of strongly-curved stream lines, the effective stresses are dominated by the bottom shear stress. It may be preferred to use separate closure models for the two important stresses. A model for the third stress is obtained by using a simple three dimensional velocity profile. J.M.S.

N79-19312# Delft Hydraulics Lab. (Netherlands).
MODEL FOR NON-STEADY SUSPENDED SEDIMENT TRANSPORT
P. J. M. Kerssens and L. C. vanRijn Nov. 1977 10 p refs Presented at the 17th Congr. of the Intern. Assoc. for Hydraulic Res., Baden-Baden, 15-19 Aug. 1977
(Publ-191) Avail: NTIS HC A02/MF A01

A mathematical model is described for suspended sediment transport which enables morphological computations to investigate the effects of human interference and/or geometrical changes in a river or estuary. The model is partly based on former research on bed-load transport models, and on the two-dimensional sediment diffusion-convection equation. This equation describes the movement of the sediment, in fact the distribution of the concentrations in the two-dimensional flow field, under the influence of diffusion, convection and gravity. The local velocities in the vertical are given by the logarithmic distribution, while for the sediment diffusion coefficient a newly derived parabolic/constant expression is applied. The diffusion equation is solved by an implicit numerical method, making use of a favorable transformation. The method is restricted to non-cohesive and nearly uniform sediment material. A test computation concerning the sedimentation in a trench was executed to verify the applicability of the mathematical model. L.S.

N79-18947# Vrije Universiteit, Brussels (Belgium).
INTRODUCTION TO THE FINITE ELEMENT METHOD AND ITS APPLICATION IN FLUID MECHANICS
Ch. Hirsch *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1976 55 p refs (For primary document see N79-18943 10-02)
Avail: NTIS HC A19/MF A01

N79-19014*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
PRECISION TEMPERATURE GRADIENT MEASUREMENTS ON WINDOW GLASS
George Mikk and Ward Petrie *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 5-14 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 20D

N79-19039*# Boeing Aerospace Co., Seattle, Wash.
APPLICATION OF AN ELECTRON BEAM FACILITY FOR HEAT TRANSFER MEASUREMENTS IN CAPILLARY TUBES
A. R. Lunde and Ted Kramer *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 377-391 ref (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 20D

N79-19043*# New Mexico State Univ., Las Cruces.
EVALUATION OF THERMAL SOAK TIMES
G. P. Mulholland and H. P. Huddleston, Jr. (White Sands Missile Range) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 435-441 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 20D

N79-19044*# General Electric Co., Utica, N. Y. Aircraft Equipment Div.
AN EFFICIENT NUMERICAL TECHNIQUE FOR CALCULATING THERMAL SPREADING RESISTANCE
E. H. Gale, Jr. *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 443-456 refs (For primary document see N79-19013 10-12)
(Contract NAS8-28616)
Avail: NTIS HC A20/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-19313 Pennsylvania State Univ., University Park.
A STUDY OF PLASTIC PHOSPHORS IN THE DEVELOPMENT

OF A HIGH SPEED SCINTILLATION CAMERA Ph.D. Thesis
Sudhakar Pandey 1978 117 p
Avail: Univ. Microfilms Order No. 7902636

A scintillation camera using fast plastic scintillators was built as a high-speed, two-dimensional, position-sensitive detector for both weakly and strongly ionizing radiation. The experimental model is similar to an Anger camera but capable of achieving counting rates of more than 1 MHz. This increase in speed is achieved through the use of plastic scintillators, instead of the conventional sodium-iodide crystals, and high-speed electronic circuitry. Dissert. Abstr.

N79-19314*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
STRAIN GAGE SYSTEM EVALUATION PROGRAM Final Report
G. W. Dolleris, H. J. Mazur, and E. Kokoszka, Jr. Dec. 1978 126 p
(Contract NAS3-20298)
(NASA-CR-159486; PWA-5615-3) Avail: NTIS HC A07/MF A01 CSCL 14B

A program was conducted to determine the reliability of various strain gage systems when applied to rotating compressor blades in an aircraft gas turbine engine. A survey of current technology strain gage systems was conducted to provide a basis for selecting candidate systems for evaluation. Testing and evaluation was conducted in an F 100 engine. Sixty strain gage systems of seven different designs were installed on the first and third stages of an F 100 engine fan. Nineteen strain gage failures occurred during 62 hours of engine operation, for a survival rate of 68 percent. Of the failures, 16 occurred at blade-to-disk leadwire jumps (84 percent), two at a leadwire splice (11 percent), and one at a gage splice (5 percent). Effects of erosion, temperature, G-loading, and stress levels are discussed. Results of a post-test analysis of the individual components of each strain gage system are presented. M.M.

N79-19315*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF MULTISPECTRAL COLOR PHOTOGRAPHY TO FLAME FLOW VISUALIZATION
G. Stoffers Feb. 1979 33 p refs Transl. into ENGLISH of "Anwendung der Multispektralfotografie zur Sichtbarmachung von Flammenstrukturen", Rept. KLR-Mitt-74-23 DFVLR, Brunswich, May 1974 1 p Original Language document was announced as N75-10420 Transl. by Kanner (Leo) Associates, Redword City, Calif.
(Contract NASw-3199)
(NASA-TM-75382; DLR-MITT-74-23) Avail: NTIS HC A03/MF A01 CSCL 14E

For flames of short duration and low intensity of radiation a spectroscopical flame diagnostics is difficult. In order to find some other means of extracting information about the flame structure from its radiation, the feasibility of using multispectral color photography was successfully evaluated. Since the flame photographs are close-ups, there is a considerable parallax between the single images, when several cameras are used, and additive color viewing is not possible. Each image must be analyzed invidividually, it is advisable to use color film in all cameras. One can either use color films of different spectral sensitivities or color films of the same type with different color filters. Sharp cutting filters are recommended. G.Y.

N79-19316*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
Ge:Ga TESTING AT CORNELL Technical Report, Jul. 1978 - Feb. 1979
D. A. Briotta, Jr. and J. R. Houck 1979 50 p
(Contract JPL-954603)
(NASA-CR-158348; CRSR-716) Avail: NTIS HC A03/MF A01 CSCL 14B

The spiking and memory behavior of a number of Ge:Ga detectors was studied. The detectors were manufactured at a number of locations using several different contacting techniques. Two detectors manufactured for the IRAS program by Rockwell International were studied more extensively than the others. These detectors IRD 1981 and IRD 1982 were 'witness sample' detectors for the IRAS bands 4 and 3, respectively. During the testing period both the apparatus and the test procedures were changed numerous times. At each change consistency checks were made. The data are believed to be internally consistent from end to end. J.M.S.

N79-19317*# National Aeronautics and Space Administration. Pasadena Office, Calif.
INTERFEROMETER Patent Application
James B. Breckinridge, inventor (to NASA) Filed 30 Nov. 1978 16 p
(NASA-Case-NPO-14502-1; US-Patent-Appl-SN-965368) Avail: NTIS HC A02/MF A01 CSCL 14B

An interferometer is presented to measure slight differences in path length of two beams, and to enable comparison of the spectrum of an unknown light source with a known source, which is insensitive to tilting. One novel feature is the use of largely platelike elements to form a beamsplitter, and with reflector surfaces at the edges of the elements, to provide tilt compensation. Another feature is that the outer surfaces of the plate-like elements are angled from parallelism with the beamsplitter interface, to avoid the effects from ghost reflections. Another feature is the separation of the elements by a thin oil film, to permit sliding of one plate relative to the other. NASA

N79-19318# Purdue Univ., Lafayette, Ind. Properties Research Lab.
SPECIAL EMISSIVITY AT HIGH TEMPERATURES Interim Report, Jan. - Jul. 1978
P. E. Johnson, D. P. DeWitt, and R. E. Taylor Sep. 1978 58 p refs
(Grant AF-AFOSR-3280-77)
(AD-A062072; PRL-163; AFOSR-78-1480TR) Avail: NTIS HC A04/MF A01 CSCL 14/2

The status of the high-temperature emissometer at the Properties Research Laboratory is summarized. The emissometer is an adjunct to the Multiproperty Apparatus which provides simultaneous measurement of ten thermophysical properties on the same sample of an electrically-conducting solid under various environmental conditions. The apparatus features rapid time-to-temperature and data acquisition under minicomputer control yielding state-of-the-art accuracy. The calibration of the emissometer, including the incorporation of some new devices and the modification of the calibration data, has been more thoroughly studied. Spectral emissivity measurements in the spectral range 2 to 12 micrometers have been made on tantalum (reference material), silicon nitride (Si3N4), silicon carbide (SiC), and a graphite composite from 1400 K to their degradation temperatures. The new data on the ceramics provides better understanding of their high temperature behavior including the effect of fabrication process and impurities. A model has been developed for relating the observed spectral radiance from a small cylindrical sample mounted within a heating tube to the optical properties (indices of refraction and absorption) and emissivity of the sample. GRA

N79-19319*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD FOR APPLYING PHOTOGRAPHIC RESISTS TO OTHERWISE INCOMPATIBLE SUBSTRATES Patent Application
Wolfgang Fuhr, inventor (to NASA) (U.S. Radium, Parsippany, New Jersey) Filed 31 Oct. 1978 11 p Sponsored by NASA (NASA-Case-MSC-18107-1; US-Patent-Appl-SN-956168) Avail: NTIS HC A02/MF A01 CSCL 14E

An improved method for applying photographic resists to otherwise incompatible substrates, such as a baking enamel paint surface, is described. The incurred enamel paint surface is coated with noncuring lacquer which is, in turn, coated with a partially cured lacquer. The noncuring lacquer adheres to the enamel and a photo resist material will satisfactorily adhere to the partially cured lacquer. Once normal photo etching techniques are employed the lacquer coats are easily removed from the enamel leaving the photo etched image. This invention is particularly applicable to preparation of edge lighted instrument panels. A coat of uncured enamel is placed over the cured enamel followed by the lacquer coats and the photo resists, which are exposed and developed

in the normal way. Once the uncured enamel is cured, the lacquer coats are removed leaving an etched panel. NASA

N79-19320# Versar, Inc., Springfield, Va.
DEVELOPMENT OF AN INFRARED SCHLIEREN SYSTEM Final Report, 1 Jun. 1972 - 28 Feb. 1978
T. D. Wilkerson, J. M. Lindsay, and Gene F. Frazier Oct. 1978 71 p refs
(Contract F44620-72-C-0076)
(AD-A062032; AFOSR-78-1451TR; Rept-122-5) Avail: NTIS HC A04/MF A01 CSCL 14/5

The research covers several aspects of gas- and flow-visualization with infrared imagery. The purpose of the research was to show that infrared analogues of standard optical methods are suitable for visualizing flow fields containing molecular gases. The infrared refractive index n of molecular gases was measured at CO2 laser frequencies. The variation of n near absorption lines forms a basis for species-selective schlieren, and other optical methods) having enhanced sensitivity to density gradients. Following preliminary tests using a x-y IR detector scanner schlieren, a new method of IR photography using conventional and Polaroid films designed for use with visible light was developed. The result was a patented process suitable for photographic IR laser patterns and other images having power densities =/100 mw/sq. cm in the wavelength range 5-10 micrometers. The method was applied to contract work on IR optics, principally to bi-prism measurements of gaseous refractive index. For comparison, high resolution interferometric measurements were made on the refractive index of air, nitrogen, ethylene and ozone at lines in the 9.6 and 10.6 micrometers CO2 laser bands. GRA

N79-19321# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
DOUBLE MICHELSON INTERFEROMETER FOR CONTACT-LESS LENGTH CHANGE MEASUREMENTS Interim Report
Ernest G. Wolff and Steve A. Eselun 6 Nov. 1978 27 p refs
(Contract F04701-78-C-0079)
(AD-A062014; TR-0079(4950-01)-1; SAMSO-TR-78-136) Avail: NTIS HC A03/MF A01 CSCL 14/2

The use of a two-channel, or double Michaelson, interferometer for measuring the absolute thermal strain epsilon of a small test sample (e.g., 4-in. long) is described. This method is contactless inasmuch as laser beams reflect off the ends of the sample. Real-time strain changes are recorded automatically to a resolution of lambda/8L sub s, where L sub s is the sample length. Analysis shows that the measurement errors are approximately proportional to the sample temperature excursion, with the strain error varying from .48 to 2 x 10 to the -7 power as Delta T sub s varies from 25 to 250 C. An average coefficient of thermal expansion for ultralow-expansion glass, measured with additional fringe interpolation by photo-detector signal analysis, would be known to + or + 1.2 times 10 to the -9th power/deg C. GRA

N79-19322# INCOSYM, Inc., Westlake Village, Calif.
INCOFLEX ACCELEROMETER PROGRAM Final Report, 19 Aug. 1977 - 30 Sep. 1978
J. Russell Sep. 1978 53 p refs
(Contract DAAK40-77-C-0181)
(AD-A061700) Avail: NTIS HC A04/MF A01 CSCL 14/2

The purpose of the contract was to improve the performance of the INCOFLEX (Trademark) accelerometer; design and develop torquing electronics with a digital output; and build and test one 2 axis and one 3-axis version of the accelerometer. Performance improvement in the long term bias stability and torquer efficiency parameters and determination of the best method of reduction of the scale factor temperature sensitivity were goals of the program. The long term bias stability was improved considerably, and the torquer design optimized as far as possible within the constraints of the design requirements. Binary, ternary and analog with-conversion-to-digital electronics were built and all three methods operated successfully with the INCOFLEX accelerometer. A three axis version of the accelerometer was built with analog electronics packaged as part of the unit. A two axis version was built and delivered with separate electronics that can torque the accelerometer in the binary, ternary or analog-with-conversion-to-digital modes. Author (GRA)

N79-19323# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
WATERPROOFING STRAIN GAGES FOR LOW AMBIENT TEMPERATURES
Donald E. Garfield and Bryan G. McLain Sep. 1978 25 p refs
(AD-A061749; CRREL-SR-78-15) Avail: NTIS HC A02/MF A01 CSCL 14/2

Due to recent problems experienced with strain-gage based transducers immersed in water at below-freezing ambient temperatures, a test program was conducted to determine if commercially available strain-gage waterproofing systems could withstand these conditions. A total of 96 combinations of eight waterproofing systems, three beam materials, and four strain gage adhesives were evaluated. Test environments included strain cycling at temperatures from -32 F to -75 F and freeze-thaw cycling from -35 F to -90 F. Only one waterproofing system withstood all tests with no failures. Other results ranged from one installation failure on three systems to the failure of all 12 installations of one system. Author (GRA)

N79-19324# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
AN INVESTIGATION OF SWITCHING BEHAVIORS OF BIMETALLIC-DISK THERMOSTATS Final Report, Apr. 1977 - Apr. 1978
W. C. Hu 30 Jun. 1978 54 p
(Contract F04701-77-C-0078)
(AD-A061866; TR-0078(3409-19)-1; SAMSO-TR-78-18) Avail: NTIS HC A04/MF A01 CSCL 13/1

Thermostatic switches that use a bimetallic, curved disk as the control element have been known to exhibit, on occasion, anomalous switching behaviors, such as a gradual drift of or sudden deviation from the original switching temperatures. A detailed analysis is presented in this report to show that a class of these switching anomalies can be attributed to an improperly designed interaction between the disk and the elastic switching armature. The analysis is based on Wittrick's theory of thermoelastic stability of the bimetallic disk, extended to include the effects of a central force. The resulting nonlinear problem was solved numerically on a digital computer with the aid of an existing solution routine for two-point boundary-value problems. Numerical results indicate that under certain combinations of geometrical, mechanical and thermal conditions, the thermostat may fail to respond to temperature changes with positive snap actions of the disk, thus resulting in the so-called temperature creepage or dithering phenomenon. Such events are usually characterized by a series of openings and closings of the contacts with reduced travel but greatly increased frequency, which can induce excessive arcing or fatigue damage that would cause the thermostat to malfunction. GRA

N79-19325# Armament Development and Test Center, Eglin AFB, Fla.
VELOCITY WINDOW DETECTOR Final Report
L. R. Caldwell Aug. 1978 48 p
(AF Proj. 9993)
(AD-A061870; ADTC-TR-78-57) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report describes a velocity window detector that senses that the velocity of a test item is within a specified tolerance, (hence, the name velocity window). If the velocity window criteria is satisfied then the detector initiates a desired event. Author (GRA)

N79-19326# Environmental Monitoring and Support Lab., Las Vegas, Nev.
TESTS OF THE DUAL DIFFERENTIAL RADIOMETER UNDER FIELD CONDITIONS Interim Report, Mar. 1972 - Sep. 1973
Robert W. Thomas Aug. 1978 32 p refs
(PB-288458/3; EPA-600/4-78-045) Avail: NTIS HC A03/MF A01 CSCL 13B

A dual differential radiometer was tested on numerous eastern United States lakes and reservoirs. Remotely sensed data were compared with ground-truth chlorophyll a values. Results indicate that the instrument has only limited application in the remote sensing of chlorophyll a in the nation's lakes. At its present

state of development, its use should be confined to large, deep, relatively clear water bodies in conjunction with ground-truth and surface survey efforts. GRA

N79-19327# National Bureau of Standards, Washington, D. C.
PRECISION LABORATORY STANDARDS OF MASS AND LABORATORY WEIGHTS
T. W. Lashof and L. B. Macurdy Oct. 1978 30 p
(PB-288661/2; NBSIR-78-1476) Avail: NTIS HC A03/MF A01 CSCL 14B

National Bureau of Standards, Circular 547 Section 1, Precision Laboratory Standards of Mass and Laboratory Weights, served for many years as a defining authority for various classes of weights and associated adjustment tolerances. Technological and organizational changes which occurred within a few years after the issuance gradually led to its obsolescence and consequently, it has been out of print for some time. In the interim, a new standard ASTM E617-78, 'Lab Weights Precision Mass Standards,' has been issued updating the same subject matter. There are still numerous requests for Circular 547 since it is widely referenced in the literature. While the document is reprinted in its entirety in NBS Handbook 77, this source is also out of print and available only at certain repository libraries. Because of technical content and historical value of Circular 547, it is being issued in the NBSIR series of documents, to be available through NTIS. It should be noted, however, that for matters concerning calibration, one should refer to the latest copy of NBS SP250, Calibration and Test Services of the National Bureau of Standards, available from the Office of Measurement Services. GRA

N79-19033*# Boeing Aerospace Co., Seattle, Wash.
THE ROLE OF LIGHT MICROSCOPY IN AEROSPACE ANALYTICAL LABORATORIES
E. R. Crutcher *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 277-287 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

N79-19041*# Martin Marietta Corp., Orlando, Fla.
HIGH TEMPERATURE STRAIN GAGE EVALUATION
Jose I. Gonzalez *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 407-423 refs Sponsored in part by Aeron. Systems Div., Wright-Patterson AFB, Ohio (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 14B

N79-19062*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN WATER VAPOR RADIOMETER: TROPOSPHERIC RANGE DELAY CALIBRATION
S. D. Slobin and P. D. Batelaan *In its* The Deep Space Network 15 May 1979 p 136-145 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-19328 Massachusetts Univ., Amherst.
LASER LIGHT SCATTERING FROM MACROMOLECULAR SOLUTIONS Ph.D. Thesis
Chun-Chen Wang 1978 295 p
Avail: Univ. Microfilms Order No. 7903860

The spectrum of light scattered from four different kinds of macromolecular solutions was examined in order to study the following problems: (1) polydispersity of an E. coli bulk tRNA sample; (2) specific dimer formation between E. coli tRNA2(Glu) and yeast tRNA(Phe); (3) effects of magnesium, temperature, and ionic strength on the conformation of tRNA molecules; and (4) interactions between ribosomal 16S RNA and the ribosomal 30S subunit binding proteins. Dissert. Abstr.

N79-19329 Stanford Univ., Calif.
PERFORMANCE OF A CONTINUOUS ELECTRICAL DISCHARGE FOR SUPERSONIC CO LASERS Ph.D. Thesis
Alan Clark Stanton 1978 287 p
Avail: Univ. Microfilms Order No. 7905930

In the analytical phase of the study, a detailed one dimensional model of vibrational nonequilibrium in flowing CO-N2 mixtures with argon or helium diluent was developed. A rate equation approach was used to model the collisional and radiative effects which determine the local vibrational population distributions. The vibrational kinetics and the one dimensional gas dynamics were fully coupled. The model can be used to predict the CO vibrational population distributions and small signal gain for the CO laser transitions in a supersonic electric discharge laser configuration. In the experimental phase of the study, a small-scale continuous-flow supersonic channel (M approximately equal to 3) was constructed and an electric discharge was operated downstream of the nozzle, transverse to the flow. The discharge was operated continuously and was stabilized by ionization from continuous auxiliary discharges at the cathode. Dissert. Abstr.

N79-19330 Purdue Univ., Lafayette, Ind.
LASER ENHANCED TRACE ANALYSIS Ph.D. Thesis
Timothy Harris 1978 142 p
Avail: Univ. Microfilms Order No. 7905727

Two separate projects are presented. The first sought to extend the sensitivity of laser intracavity absorption enhancement applied to fluid samples. The second was directed to improvements of sources of modulated light. Quantitation of absorbance for aqueous samples were accomplished with a detection limit factor for ten better than previously reported. Calibration curves were completed for absorbance ranging from 0.001/cm through 0.00002/cm in a 1 cm cell. Measurement of chemical reaction rates was successfully completed using this device. Light amplitude modulated at 0.01 Hz to 60 MHz and heterodyne modulated at 100 to kHz to 1.2 GHz was produced. Dissert. Abstr.

N79-19331 Kansas State Univ., Manhattan.
A STUDY OF EXCITON LIFETIMES IN CUPROUS OXIDE USING TUNABLE DYE LASERS Ph.D. Thesis
Robert Martin Habiger 1978 101 p
Avail: Univ. Microfilms Order No. 7906773

A pulsed tunable dye laser and a continuous wave dye laser were used to study the dominant decay mechanisms for the 1S yellow exciton in cuprous oxide. These decay channels are acoustical phonon absorption and emission and nonradiative decay. A direct decay time measurement using the pulsed laser indicated a subnanosecond lifetime. The natural linewidth of the exciton state corresponding to direct photon absorption was determined by the Raman enhancement profiles near resonance with this exciton state. The temperature dependence of this linewidth was calculated. The results indicate a total exciton lifetime of 3 x 10 to the -11th power seconds for zero momentum and lattice temperatures near 6 K. The observed lifetimes and calculated momentum dependence are then applied to an analysis of three separate experiments. Dissert. Abstr.

N79-19332 California Inst. of Tech., Pasadena.
THIN FILM BRAGG LASERS AND WAVEGUIDES BY LIQUID PHASE EPITAXY Ph.D. Thesis
Willie Wing Lav Ng 1979 202 p
Avail: Univ. Microfilms Order No. 7906213

The theory and device applications of periodically corrugated thin film waveguides are described. Specifically, the main concern is their use as Bragg reflectors and grating output couplers in GaAs semiconductor lasers. The theory of periodic thin film waveguides is well described by the coupled mode formalism. Experimental work with optically pumped and heterojunction GaAs distributed Bragg reflector lasers operating with distributed feedback in the third and fourth order is also described. Optical waveguides that utilize the Bragg reflectivity provided by multilayers of GaAs and GaAlAs for light confinement are examined. The excitation and observation of optical surface waves in a stratified medium of GaAs and GaAlAs grown by liquid phase epitaxy is described. Finally, various fabrication and measurement techniques developed for the experiments are presented. Dissert. Abstr.

N79-19333*# Arkansas Univ., Little Rock. Dept. of Electronics and Instrumentation.

NEPHELOMETER EVALUATION FOR MEASUREMENT OF CLOUD PARAMETERS IN EARTH AND PLANETARY ATMOSPHERES Semiannual Progress Report, Mar. 1978 - Aug. 1978
G. S. Ballard and M. K. Testerman 22 Mar. 1979 28 p
(Grant NGL-04-001-007)
(NASA-CR-158156) Avail: NTIS HC A03/MF A01 CSCL 20E

Initial work was concerned with determining whether the radiation emitted from a laser source could be sufficiently collimated to provide a suitable source for a nephelometer-type instrument. It was necessary to develop a standard scatterer that could be used to evaluate the performance of a nephelometer. The possible use of a gallium arsenide diode as a radiation source also was investigated. The first of these utilized a single lens to focus the light scattered from a target onto a ring detector. The second configuration used reflecting and refracting axicons as optical-system elements. The work performed in each of these areas is described. G.Y.

N79-19334*# Illinois Univ. at Urbana-Champaign, Urbana.
AN EXPERIMENTAL INVESTIGATION OF (UF-235)6 FISSION NUCLEAR-PUMPED LASERS Progress Report
George H. Miley Feb. 1979 28 p refs
(Grant NsG-1547)
(NASA-CR-158162) Avail: NTIS HC A03/MF A01 CSCL 20E

A UF6 handling system was designed for use in conjunction with the existing nuclear-pumped laser vacuum system at a nuclear reactor laboratory to perform the experiments described above. A modification to separate the gas fill system from the vacuum system and thus greatly reduce its volume is described as well as operating procedures for the first controlled nuclear pumping experiments with UF6 vapor contained in the laser cell. A.R.H.

N79-19335*# Case Inst. of Tech., Cleveland, Ohio.
APPLICATIONS OF HIGH POWER LASERS Final Report
John C. Angus 21 Mar. 1979 19 p refs
(Grant NsG-3074)
(NASA-CR-158234) Avail: NTIS HC A02/MF A01 CSCL 20E

The use of computer generated, reflection holograms in conjunction with high power lasers for precision machining of metals and ceramics was investigated. The Reflection holograms which were developed and made to work at both optical wavelength (He-Ne, 6326 A) and infrared (CO2, 10.6) meet the primary practical requirement of ruggedness and are relatively economical and simple to fabricate. The technology is sufficiently advanced now so that reflection holography could indeed be used as a practical manufacturing device in certain applications requiring low power densities. However, the present holograms are energy inefficient and much of the laser power is lost in the zero order spot and higher diffraction orders. Improvements of laser machining over conventional methods are discussed and addition applications are listed. Possible uses in the electronics industry include drilling holes in printed circuit boards making soldered connections, and resistor trimming. A.R.H.

N79-19336# School of Aerospace Medicine, Brooks AFB, Tex.
FORMAT OF REVISED SAFETY STANDARDS FOR INFRARED LASER EXPOSURES Final Report, Nov. 1977 - Mar. 1978
Ronald D. Reed Oct. 1978 20 p refs
(AD-A061800; SAM-TR-78-29) Avail: NTIS HC A02/MF A01 CSCL 06/18

A thermal model has been normalized to experimental damage threshold data for corneal injury (minimum epithelium lesions) from infrared lasers. Subsequent damage threshold predictions (as a function of exposure duration and absorption coefficient) are approximated by general equations and threshold curves. The formulated equations are adapted to indicate the wavelength dependence of infrared laser damage. A revised format for the ANSI Z136.1-1976 laser safety standard is proposed on the basis of these analyses. Author (GRA)

N79-19337# Letterman Army Inst. of Research, San Francisco, Calif.
REPETITIVE PULSE LASER DATA AND PERMISSIBLE EXPOSURE LIMITS Final Report, 1 Sep. 1977 - 31 Mar. 1978
Bruce E. Stuck, David J. Lund, and Edwin S. Beatrice May 1978 72 p refs
(AD-A061654; LAIR-58) Avail: NTIS HC A04/MF A01 CSCL 06/10

Two methods are described for the calculation of permissible ocular exposure to repetitive pulse laser radiation. The rationale for these methods (the correction factor method and the alternate method) is based upon available experimental data from several laboratories. The ED (sub 50)s (Effective dose for 0.50 probability of an ophthalmoscopically visible retinal lesion) for repetitive pulse exposures expressed in terms of the total intraocular energy are proportional to the pulse train duration to the 3/4 power. The continuous wave ED(sub 50)s exhibit the same dependence on the exposure duration; however, the repetitive pulse ED(sub 50)s were always some factor below the continuous wave ED(sub 50)s. This correction factor is dependent on the pulse repetition frequency and the duration of each individual pulse in the train. It was applied as a multiplicative correction to the continuous wave maximum permissible exposure to obtain the permissible exposure for repetitive pulse condition. GRA

N79-19338# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
FORMATION AND DEACTIVATION PROCESSES IN ELECTRONIC TRANSITIONS, CHEMICALLY PUMPED LASERS Final Report, 1 Sep. 1974 - 30 Sep. 1978
Jeffrey I. Steinfeld 1 Oct. 1978 12 p refs
(Grant AF-AFOSR-2758-75)
(AD-A062005; AFOSR-78-1509TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

Research was performed on the rates of formation of excess populations of electronically excited small molecules, particularly in chemiluminescent metal oxidant reactions, and characterization of the deactivation processes which tend to relax these excited states. Results were obtained in the following areas: (1) aluminum-ozone reaction (2) lanthanum-oxidant reactions; (3) reactions of silanes and boranes with oxidants; (4) scandium and yttrium oxidant reactions; (5) titanium - oxidant reaction; (6) chemiluminescent reactions of the Group IIIB metals; (7) optical model for surface crossing; (8) Information-Theoretic analysis of deactivation rates; (9) Spectroscopy and deactivation of CN A-2Pi; (10) near-resonant electronic energy transfer; and (11) multiphoton CO2 laser vibrational heating of metastable electronic states. Author (GRA)

N79-19339# Battelle Columbus Labs., Ohio.
EARLY HEATING PROCESSES IN LASER-SUPPORTED DETONATION (LSD) WAVE INITIATION ON METALS AND ALLOYS Final Report, 15 Aug. 1976 - 15 Aug. 1978
C. T. Walters and A. H. Clauer 15 Oct. 1978 73 p refs
(Contract DAAG29-76-C-0059)
(AD-A061918; ARO-14045.2-MS) Avail: NTIS HC A04/MF A01 CSCL 11/6

This report presents results of a two-year experimental study of early heating processes on metal and alloy surfaces under pulsed laser irradiation conditions which are known to give rise to so-called laser-supported detonation (LSD) waves at 10.6 micrometers. The results are applicable to the understanding of LSD-wave initiation as well as to the understanding of pulsed heating of metals in general. The approach consisted of studying the time-resolved specular reflectivity of metal samples subjected to intense TEA CO2 laser radiation (50-100 ns pulse width) in a vacuum. The experimental configuration was selected to give a high degree of beam homogeneity on the sample surface. Metallographic examination of samples was performed to correlate changes in the surface structure with reflectivity results. Metals studied included aluminum, copper, iron, nickel, titanium, Al 2024, and Ti-6-4. The data obtained were the first of their kind recorded at 10.6 micrometers and revealed an anomalous effect in the specular reflectivity transient. The effect consisted of a sharp drop in reflectivity midway in the pulse to a low value (5-40%) followed by recovery to nearly the initial value late in the pulse. The effect was studied most extensively with aluminum, but was found to occur generally in the other materials irradiated. Considerable differences in thresholds and details of the effect

were found which were attributable to materials effects and alloying. GRA

N79-19340# Avco-Everett Research Lab., Mass.
EXCIPLEX LASER KINETICS Interim Report, 1 Mar. - 31 Jul. 1978
A. Mandl and J. H. Parks 31 Jul. 1978 30 p refs
(Contract N00014-78-C-0334; DARPA Order 3500)
(AD-A061863) Avail: NTIS HC A03/MF A01 CSCL 20/5

Measurements of the rates of collisional quenching of $HgCl^*$ and $HgBr^*$ (B 2 Sigma (-) 1/2) by rare gases and halogenated molecules are reported in this paper. $HgCl^*$ and $HgBr^*$ fluorescence is produced by photolyzing HgCl2 and HgBr2 respectively using $Xe2^*$ radiation. A background pressure of (Xe) = 100 torr ensures that the $HgCl^*$ and $HgBr^*$ is vibrationally relaxed. The rates are derived by using a modified Stern-Volmer analysis and estimated lifetime of the $HgCl^*$ and $HgBr^*$ (B 2 Sigma (-) 1/2) states of 29 nsec and 23 nsec, respectively. Author (GRA)

N79-19987# Joint Publications Research Service, Arlington, Va.
LASER APPLICATIONS REVIEWED, IMPORTANCE STRESSED
F. Bunkin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 61 (JPRS-72988) 13 Mar. 1979 p 40-44 Transl. into ENGLISH from Izvestiya (Moscow), 30 Jan. 1979 p 3 (For primary document see N79-19983 10-99)
Avail: NTIS HC A04/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-19341 Iowa Univ., Iowa City.
TWO DIMENSIONAL SHAPE OPTIMAL DESIGN Ph.D. Thesis
Young Wha Chun 1978 135 p
Avail: Univ. Microfilms Order No. 7902885

In a shape optimal design problem, the region on which the governing equations and the cost and constraint functionals of the problem are defined is selected to meet an optimization objective. Thus, when the variations of the functionals involved in the design problem are considered the effect of a change in geometry must be predicted. A technique from the calculus of variations is utilized, which enables the variation of a functional over a variable region to be expressed as a functional over a fixed region. An adjoint variable method of operator theory is then used to reduce this variation to an explicit function of only design changes. The resulting sensitivity coefficients can be used to aid the designer in selecting an improved design, or they may be used in an iterative optimization algorithm, as is done in the method presented. Dissert. Abstr.

N79-19342 Dayton Univ., Ohio.
DESIGN AND ANALYSIS OF HIGH PRESSURE APPARATUS TO DETERMINE EQUILIBRIUM PHASE DIAGRAMS WITH APPLICATION TO LUBRICANTS Ph.D. Thesis
Kurt Christian Rolle 1978 202 p
Avail: Univ. Microfilms Order No. 7904247

A detailed design of a high pressure test apparatus and the methods of testing to obtain equilibrium phase diagrams for liquids and viscous lubricants to 2800 MPa (410,000 psi) and between 223K (-60 F) and 378K (220 F) are presented. A complete description of the component parts, calibration procedures, and analytic corrections are also given. The stresses and radial deformation of an elastic material caused by a localized hydrostatic pressure in a cylindrical hole were determined. The general case for predicting stresses and radial deformation with any band width of pressure was considered. The results can be used with suitable superposition techniques to treat any band width without further extensive calculations. The width of the band of hydrostatic pressure qualitatively does not change the stress distribution in the material but does account for magnitude differences in the stresses and deformation. Dissert. Abstr.

N79-19343 Lehigh Univ., Bethlehem, Pa.
LIQUID LEVEL CONTROL Ph.D. Thesis
Tak-Fai Cheung 1978 179 p
Avail: Univ. Microfilms Order No. 7904299

The problems of controlling liquid level in a single tank, in a cascade of tanks, and in a recycle system with conventional P and PI controllers were examined. The noise filtering characteristics given by both controllers were shown quantitatively. Propagation of response oscillations in a cascade of PI controlled tanks was observed. Design charts were developed to aid in the correct tuning of the controllers. The tuning method proposed is based on specifications of the responses in maximum level peak height and maximum rate of change in outflow.
Dissert. Abstr.

N79-19344 Northwestern Univ., Evanston, Ill.
EFFECTS OF SURFACE ROUGHNESS ON PARTIAL FILM LUBRICATION USING AN AVERAGE FLOW MODEL BASED ON NUMERICAL SIMULATION Ph.D. Thesis
Nadir Patir 1978 158 p
Avail: Univ. Microfilms Order No. 7903340

An average flow model is introduced to determine the effects of surface roughness in partially lubricated contacts. An average Reynolds equation governing the mean pressure in rough bearings is derived in terms of empirical flow factors which are functions of the roughness characteristics. The flow factors are obtained for isotropic surfaces and for surfaces with directional patterns. Most of the results are obtained for surfaces having a Gaussian distribution of roughness heights, but the effect of skewed distributions is also investigated using a Gamma distribution. The average flow model is utilized to determine the effects of roughness in finite slider bearings. A complete solution for the inlet half of rough elastohydrodynamic line contacts operating in the partial lubrication regime is obtained. The effects of various operating parameters as well as the roughness parameters are investigated. Dissert. Abstr.

N79-19345 California Univ., Berkeley.
THE THERMOMECHANICS OF DRY AND LUBRICATED CONTACTS BETWEEN DEFORMABLE SOLIDS Ph.D. Thesis
Alain Roger Curnier 1978 224 p
Avail: Univ. Microfilms Order No. 7904413

A unified theory for the thermomechanical formulation and solution of dry and lubricated contact problems between deformable solids is developed and its validity illustrated on one important application: thermoelasto-hydrodynamic lubrication.
Dissert. Abstr.

N79-19348*# Midwest Research Inst., Kansas City, Mo.
LUBRICATION HANDBOOK FOR THE SPACE INDUSTRY. PART A: SOLID LUBRICANTS. PART B: LIQUID LUBRICANTS Final Report
Sep. 1978 497 p
(Contract NAS8-31715)
(NASA-CR-161109) Avail: NTIS HC A21/MF A01 CSCL 11H

This handbook is intended to provide a ready reference for many of the solid and liquid lubricants used in the space industry. Lubricants and lubricant properties are arranged systematically so that designers, engineers, and maintenance personnel in the space industry can conveniently locate data needed for their work. A compilation of solid lubricant suppliers information on chemical and physical property data of more than 250 solid lubricants, bonded solid lubricants, dispersions and composites is presented along with a compilation of chemical and physical property data of more than 250 liquid lubricants, greases, oils, compounds and fluids. The listed materials cover a broad spectrum, from manufacturing and ground support to hardware applications of missiles and spacecraft. F.O.S.

N79-19347*# Systems Research Lab., Champaign, Ill.
DIGITAL CONTROLLER DESIGN: ANALYSIS OF THE ANNULAR SUSPENSION POINTING SYSTEM Final Report
B. C. Kuo 1 Mar. 1979 187 p refs
(Contract NAS8-32358)
(NASA-CR-161172; Rept-1-7-ED-07418(1F)) Avail: NTIS

HC A09/MF A01 CSCL 13I

The Annular Suspension and Pointing System (ASPS) is a payload auxiliary pointing device of the Space Shuttle. The ASPS is comprised of two major subassemblies, a vernier and a coarse pointing subsystem. The experiment is attached to a mounting plate/rim combination which is suspended on magnetic bearing/actuators (MBA) strategically located about the rim. Fine pointing is achieved by gimballing the plate/rim within the MBA gaps. Control about the experiment line-of-sight is obtained through the use of a non-contacting rim drive and positioning torquer. All sensors used to close the servo loops on the vernier system are noncontacting elements. Therefore, the experiment is a free-flyer constrained only by the magnetic forces generated by the control loops. G.Y.

N79-19348# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

INDUSTRIAL COMPRESSORS, VOLUME 1

1976 308 p refs Lecture held at Rhode Saint Genese, Belgium, 10-14 May 1976 2 Vol.

(VKI-Lecture-Series-91-Vol-1) Avail: NTIS HC A14/MF A01

Volume 1 of a two volume lecture series is presented. Topics discussed in this volume include: (1) influence of gas properties on compressor design; (2) turbomachinery flutter; (3) identification of various flutter regimes and dynamic stall; (4) application of theory to design; and (5) design and construction of a gas turbine engine. For individual titles, see N79-19349 through N79-19355.

N79-19349# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

INDUSTRIAL COMPRESSORS, INTRODUCTION

F. A. E. Breugelmans *In its* Ind. Compressors, Vol. 1 1976 10 p refs (For primary document see N79-19348 10-37)

Avail: NTIS HC A14/MF A01

A general introduction to this lecture series is presented. The air compressor, compressors for gases heavier than air, and compressors for gases lighter than air are briefly discussed. G.Y.

N79-19350# Gutehoffnungshuette Sterkrade A. G., Oberhausen (West Germany).

INFLUENCE OF GAS PROPERTIES ON COMPRESSOR DESIGN

H. Griepentrog *In* Von Karman Inst. for Fluid Dyn. Ind. Compressors, Vol. 1 1976 23 p refs (For primary document see N79-19348 10-37)

Avail: NTIS HC A14/MF A01

An attempt is made to point out some of the problems connected with the use of different types of gases in axial compressors. Apart for compressing air, these compressors show their reliability in the fields of application for other gases. G.Y.

N79-19351# Nuovo Pignone S.p.A., Florence (Italy).

TRANSONIC COMPRESSORS FOR HEAVY GASES. PART 1: SELECTIONS OF THE AERO-DESIGN PARAMETERS

E. Benvenuti *In* Von Karman Inst. for Fluid Dyn. Ind. Compressor, Vol. 1 1976 31 p refs (For primary document see N79-19348 10-37)

Avail: NTIS HC A14/MF A01

The problems of correctly applying test data obtained for cascades and stages operating with air to designing heavy gas compressor stages are outlined. Some differences to be expected in the compressor performance are examined. It is concluded that the aerodynamic design of a multistage transonic axial compressor for very heavy gases has in general more severe constaints than the design of an air compressor of the same pressure ratio and specific flow. Some criteria for the selection of the design aerodynamic parameters are indicated, when high efficiency and good operating range are requested. G.Y.

N79-19352# Nuovo Pignone S.p.A., Florence (Italy).

TRANSONIC COMPRESSORS FOR HEAVY GASES. PART 2: AERO-MECHANICAL CONSIDERATIONS, TESTING AND OPERATION

E. Benvenuti *In* Von Karman Inst. for Fluid Dyn. Ind. Compressors, Vol. 1 1976 34 p refs (For primary document see N79-19348 10-37)

Avail: NTIS HC A14/MF A01

Some comparisons are made between the design of transonic stages operating with air and that of stages operating with heavy gases, taking blades stresses, natural frequencies and flutter into consideration. It is shown that, in general, the mechanical constaints on the aerodynamic design are less severe for the heavy gas compressor than for the equivalent air compressor. When testing a compressor design for a certain gas using different gas, care must be taken in selecting the test gas properties and an appropriate data correlation must be used by defining performance parameters, suitable to represent the compressor performance when operating with different gases. Performance maps are shown, which were calculated on the basis of typical stage characteristics, using, the stage-stacking technique. G.Y.

N79-19353# United Technologies Research Center, East Hartford, Conn.

TURBOMACHINERY FLUTTER: INTRODUCTORY CONCEPTS

Franklin O. Carta *In* Von Karman Inst. for Fluid Dyn. Ind. Compressors, Vol. 1 1976 26 p refs (For primary document see N79-19348 10-37)

Avail: NTIS HC A14/MF A01

An attempt is made to acquaint the reader with several turbomachinery flutter problems confronting the design engineer. Some of the ways in which the designer can cope with these problems are suggested. The reader is exposed to the basic differences between wing flutter and turbomachinery blade flutter. This is helpful in establishing the areas in which elementary theories can be used to explain basic principles. G.Y.

N79-19354# United Technologies Research Center, East Hartford, Conn.

IDENTIFICATION OF VARIOUS FLUTTER REGIMES AND DISCUSSION OF DYNAMIC STALL

Franklin O. Carta *In* Von Karman Inst. for Fluid Dyn. Ind. Compressors, Vol. 1 1976 45 p refs (For primary document see N79-19348 10-37)

Avail: NTIS HC A14/MF A01

An attempt is made to identify several of the specific flutter problems that are of concern to the turbomachinery designer. Following a general historical account of the early attempts to cope with various flutter problems relevant to turbomachines, a detailed survey of single degree of freedom torsional stall flutter is given. Although the phenomenon is experienced by all rotating blade systems, only isolated airfoil studies relevant to helicopters and propellers are extensive enough to produce a truly predictive design system. However, this prediction relies heavily on empiricism. G.Y.

N79-19355# Ateliers de Constructions Electriques de Charleroi (Belgium).

DESIGN AND CONSTRUCTION OF THE COMPRESSOR OF THE ACEC-WESTINGHOUSE 100 mW GAS TURBINE ENGINE

J. L. Guiette, A. VanGucht, and G. Carnewal *In* Von Karman Inst. for Fluid Dyn. Ind. Compressors, Vol. 1 1976 28 p (For primary document see N79-19348 10-37)

Avail: NTIS HC A14/MF A01

The general design method used to develop a large axial compressor which is part of a large industrial gas turbine is described. It is shown how during the design phase external factors such as changing marketing requirements can alter the initial design. After the design criteria are outlined, it is shown how these are applied to the design of a compressor which fits a 100 megawatts gas turbine. A general description of the gas turbine and its observation are given. G.Y.

N79-19356# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

INDUSTRIAL COMPRESSORS, VOLUME 2

1976 246 p refs Lecture held at Rhode Saint Genese, Belgium, 10-14 May 1976 2 Vol.

(VKI-Lecture-Series-91-Vol-2) Avail: NTIS HC A11/MF A01

Volume 2 of a two volume lecture series is presented. In this volume the following topics are discussed: (1) variable

geometry axial compressors; (2) field measurements of blade stresses; (3) static and dynamic properties of radial sliding bearings; (4) vibrational behavior of rotors on journal bearings; (5) aerodynamic and mechanical factors affecting the surge line - the Reynolds number effects in axial flow compressors, the clearance effects in axial flow compressors, the erosion affects in axial flow compressors, the casing treatment in axial flow compressors, and inlet flow distortion influence on axial flow compressors. For individual titles, see N79-19357 through N79-19363.

N79-19357# Sulzer Bros. Ltd., Winterthur (Switzerland).
VARIABLE GEOMETRY AXIAL COMPRESSORS. FIELD MEASUREMENTS OF BLADE STRESSES
R. Jenny and R. A. Strub *In* Von Karman Inst. for Fluid Dyn. Ind. Compressors, Vol. 2 1976 105 p refs (For primary document see N79-19356 10-37)
Avail: NTIS HC A11/MF A01

Using a simple flow model based on velocity triangles, the basic behavior of a single stage can be described. Considerations show that guide vane control is especially efficient with low reaction bladings. Some test results for different secondary effects of stages with low and high degree of reaction are discussed. From a short description of the mutual interractions of the stages in a multistage compressor, the different laws of setting guide vanes can be understood. Some operational experiences are reported. G.Y.

N79-19358# Kraftwerk Union A.G., Mulheim (West Germany).
STATIC AND DYNAMIC PROPERTIES OF RADIAL SLIDING BEARINGS, 1. VIBRATIONAL BEHAVIOUR OF ROTORS ON JOURNAL BEARINGS
E. Pollmann *In* Von Karman Inst. for Fluid Dyn. Ind. Compressors, Vol. 2 1976 50 p refs (For primary document see N79-19356 10-37)
Avail: NTIS HC A11/MF A01

In the first part of this lecture, the basis and procedure for calculating the static and dynamic properties of radial sliding bearings are presented. The second part deals with the influence of the bearings on stability, damping and resonance amplification of a so called one-mass rotor, also called a Laval rotor. G.Y.

N79-19359# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMICS AND MECHANICAL FACTORS AFFECTING THE SURGE LINE: THE REYNOLDS NUMBERS IN AXIAL FLOW COMPRESSORS
F. A. E. Breugelmans *In its* Ind. Compressors, Vol. 2 1976 11 p refs (For primary document see N79-19356 10-37)
Avail: NTIS HC A11/MF A01

Studying Reynolds number and scale effects provides the rules for the translation of model tests, altitude experiments and the influence of special gases into the performance of the real machine. The performance is characterized by the pressure ratio (mass flow) efficiency relations and their dependence on Reynolds number. The pressure ratio is influenced by the turning capability and the overall diffusion of the blade rows. The efficiency is related to the loss mechanisms: friction, shock waves, development of boundary layers on the blade surfaces and casings, secondary flows and mixing. All these phenomena are basically Reynolds number dependent. G.Y.

N79-19360# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMIC AND MECHANICAL FACTORS AFFECTING THE SURGE LINE: THE CLEARANCE EFFECTS IN AXIAL FLOW COMPRESSORS
F. A. E. Breugelmans *In its* Ind. Compressors, Vol. 2 1976 8 p refs (For primary document see N79-19356 10-37)
Avail: NTIS HC A11/MF A01

The allowance for the mechanical deformations and vibrations necessitates a clearance between the moving and stationary parts of the multistage compressors. A leakage flow occurs at the blade extremities and interacts with the main throughflow; the blade loading capacity is modified and premature stall occurs. This clearance effect is reviewed, the performance loss are correlated and other scaling systems are discussed for their relative merits. G.Y.

N79-19361# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMIC AND MECHANICAL FACTORS AFFECTING THE SURGE LINE: THE EROSION EFFECTS IN AXIAL FLOW COMPRESSORS
F. A. E. Breugelmans *In its* Ind. Compressors, Vol. 2 1976 7 p refs (For primary document see N79-19356 10-37)
Avail: NTIS HC A11/MF A01

The erosion, blade roughness, blade shape variations and fouling modify the surgeline. Some of these effects cause a permanent shift of the surgeline, others allow a partial restoration by means of a cleaning process. The manufacturing tolerances and blade shape deterioration during the compressor lifetime have to be taken into account in the definition of the operating line with respect to the shifting surgeline. The operation of a turbomachine in a dusty gas is summarized by a review of the properties of dusty air, the erosion process and the blade section performance. G.Y.

N79-19362# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMIC AND MECHANICAL FACTORS AFFECTING THE SURGE LINE: THE CASING TREATMENT IN AXIAL FLOW COMPRESSORS
F. A. E. Breugelmans *In its* Ind. Compressors, Vol. 2 1976 13 p refs (For primary document see N79-19356 10-37)
HC A11/MF A01

The acoustic studies for the quiet compressor and the compressor bleed systems led to the introduction of casing treatment. It was observed that, in addition to the acoustical benefits, better aerodynamic performance was obtained. Bleeding-off the low boundary layer increased the resistance to an adverse pressure gradient and a similar effect is provided with well-chosen cavities, slots, grooves or honeycomb casings. G.Y.

N79-19363# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMIC AND MECHANICAL FACTORS AFFECTING THE SURGE LINE: INLET FLOW DISTORTION INFLUENCES ON AXIAL FLOW COMPRESSORS
J. Colpin *In its* Ind. Compressors, Vol. 2 1976 15 p refs (For primary document see N79-19356 10-37)
Avail: NTIS HC A11/MF A01

An inlet flow distortion is one of the compressor perturbations to be considered in designing a turbomachine. Two of the most important practical methods, the parallel compressor model and the Melick model, available for the prediction of the effects of inlet flow distortion on the surge line shift are presented. It appears that both models give satisfactory results, at the moment, but without adding new fundamental elements to the knowledge of the flow phenomena. This would necessarily reduce their range of application. There is a need for a deeper insight in the flow physics in order to link the global approach to a detailed study of the unsteady response of the rotating rows which would improve the prediction methods. G.Y.

N79-19364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COUPLING DEVICE FOR MOVING VEHICLES Patent Application
Arthur A. Rudmann, inventor (to NASA) 6 Feb. 1979 23 p (NASA-Case-GSC-12429-1; US-Patent-Appl-SN-009888) Avail: NTIS HC A02/MF A01 CSCL 13I

A device is presented for attachment to the arm of a remote manipulator system carried by a first space vehicle for grasping, aligning and firmly coupling with a payload in the form of a satellite or other object which is in substantial misalignment and/or rotating with respect to the coupling device. The coupling device is characterized by its simplicity, light-weight, small size, low cost and, most importantly, its reliability. Although the device was designed primarily for use in coupling space vehicles, smaller versions of the device can conceivably be used on the end of any remote type manipulator arm such as, for example, those used in handling radioactive materials or in undersea exploration. NASA

N79-19365# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

COMBUSTION PROBLEMS IN GAS TURBINE APPLICATIONS
1977 505 p refs Proc. of lectures held on 10-14 Jan. 1977 (VKI-Lecture-Series-93) Avail: NTIS HC A22/MF A01

A discussion is given of the combustion problems in gas turbines with emphasis on the combustion process, the combustion chamber, and application in the aeronautical and industrial fields. For individual titles, see N79-19366 through N79-19381.

N79-19366# Purdue Univ., Lafayette, Ind.
COMBUSTION IN THE GAS TURBINE, PARTS 1, 2, 3
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 28 p (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

Reference to the conventional P-V diagram for a turbo-jet cycle shows that between the compression and expansion stages there is a stage in which the working fluid (air) expands at constant pressure. This expansion is achieved in a practical system through heating of the air by injection and combustion of a liquid fuel. The useful work output of the engine is related to the area within the P-V loop. Thus a large degree of expansion will give a large work output. Since, however, the gas is being expanded by raising its temperature, a practical limit to the degree of expansion attainable is set by the maximum temperature limits of the engine components, especially the turbine. L.S.

N79-19367# Purdue Univ., Lafayette, Ind.
RELATIVE MERITS OF VARIOUS TYPES OF COMBUSTION
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 3 p (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

The advantages and disadvantages of the tubular types, annular types, and tubo-annular types of combustion chambers are given. It is stated that annular chambers of the 'straight-through' or 'reverse flow' type are now the normal choice for most aircraft engines. L.S.

N79-19368# Purdue Univ., Lafayette, Ind.
FUEL INJECTION
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 43 p (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

A survey is presented of various methods of achieving an atomized spray and to the influence of atomizer geometry and chamber operating conditions on spray characteristics. The influence of spray characteristics on various important aspects of combustion performance is discussed. Attention is centered mainly on pressure atomizers, but consideration is also given to other methods of atomization, such as air-blast atomization and centrifugal atomization. A brief discussion is given on the relative merits of the various types of fuel injector, with particular emphasis on aircraft systems in which the fuel injection process plays a much more dominant role than in the case of industrial engines. L.S.

N79-19369# Purdue Univ., Lafayette, Ind.
DIFFUSERS FOR GAS TURBINE COMBUSTION SYSTEMS
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 12 p refs (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

It is a characteristic of axial flow compressors that a high axial velocity is needed to achieve a high outlet pressure in a small number of stages. Thus it is necessary to reduce the velocity of the compressor efflux. A five-fold reduction is typical, and is achieved by fitting a diffuser between the compressor outlet and the upstream end of the flame tube. The simplest, and aerodynamically most efficient diffuser is a diverging circular duct. Such a diffuser will have an optimum divergence angle for minimum pressure loss, and consideration of the flow regimes in a diffuser of increasing angle will show the physical basis for such an optimum. L.S.

N79-19370# Purdue Univ., Lafayette, Ind.
COMBUSTION IN THE GAS TURBINE
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 27 p refs (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

The so-called 'burning velocity' and 'reaction rate' theories are described and their relative merits compared. Also, an alternative description of the combustion process is presented which, although of no direct application to combustor design, allows observed combustion characteristics to be more readily interpreted in terms of the basic physical and chemical processes involved. The various applications of a performance parameter derived from the burning velocity theory to the design and performance evaluation of combustion chambers are described in some detail. The uses and limitations of various heat release criteria are also discussed. L.S.

N79-19371# Purdue Univ., Lafayette, Ind.
REHEAT DESIGN
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 6 p (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

The equations for the calculations of the reheat design are presented. L.S.

N79-19372# Purdue Univ., Lafayette, Ind.
IGNITION IN THE GAS TURBINE
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 45 p refs (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

The trend towards higher flight speeds and engines of higher compression ratio produced a gradual deterioration in the environmental conditions of the ignition unit and igniter plug. At the same time there has been an increasing demand for improvements in performance, life and reliability of ignition equipment. Thus, the problem of ignition, particularly in aircraft engines, is one of continuing importance and is discussed in some detail. L.S.

N79-19373# Purdue Univ., Lafayette, Ind.
FLAME STABILIZATION
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 20 p refs (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

The aircraft chamber is called upon to operate at very low temperatures and pressures, and at fuel-air ratios that lie well outside the limits of inflammability for hydrocarbon/air mixtures. Combustion must be initiated and sustained in air streams moving at speeds many times greater than the normal burning velocity of the fuels employed. Moreover, the flame must cope with the various abnormal conditions that are sometimes encountered in flight, such as those created by the ingestion of tropical rain or ice. In well-designed combustion chambers good stability performance is usually attained without undue difficulty. However, in future chamber designs it is not unlikely that current views on what is acceptable in terms of stability performance may have to be modified considerably. For this reason it is essential that the combustion engineer should be fully aware of all the factors that limit and control stability in practical combustion systems. L.S.

N79-19374# Purdue Univ., Lafayette, Ind.
OPTIMIZATION OF FLAME-TUBE DIMENSIONS
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 12 p refs (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

The optimum casing cross-sectional area (A sub C) of a G.T. combustor can be determined by a pressure loss or combustion-based approach. It is generally found that the minimum value determined from the combustion approach is so low as to give an unacceptably high overall pressure loss. That the value of A sub C derived from a pressure-loss analysis is normally used is convenient in the context of the discussion;

optimization of other flame tube dimensions is based on pressure loss/mixing considerations, so a consistent approach results, annular chambers and 30-40 for tubular systems. It becomes evident during optimization of the flame tube dimensions whether the value chosen is reasonable. L.S.

N79-19375# Purdue Univ., Lafayette, Ind.
COKE DEPOSITION AND EXHAUST SMOKE
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 21 p refs (For primary document see N79-19365 10-37)
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Soot may be generated in any part of the combustion zone where mixing is inadequate, but for spray combustors the main soot-forming region lies inside the fuel spray at the center of the flame tube. This is the region in which the recirculating burnt products move upstream towards the fuel spray and where local pockets of fuel and fuel vapour are completely surrounded by oxygen-deficient gases at high temperature. In these fuel-rich regions soot may be produced in considerable quantities. Most of it is subsequently consumed in the main combustion zone, and the remainder is either deposited on the flame tube walls or is discharged with the exhaust gases. When it adheres to the wall it is called coke; when it is discharged from the chamber it is called smoke. L.S.

N79-19376# Purdue Univ., Lafayette, Ind.
CONTROL OF AIR POLLUTION FROM AIRCRAFT AND AIRCRAFT ENGINES
A. H. Lefebvre *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 5 p (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

Tables and graphs are presented of the data relating to air pollution from aircraft and aircraft engines. L.S.

N79-19377# Sheffield Univ. (England).
COMBUSTION FUNDAMENTALS
J. Swithenbank *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 p 1-126 refs (For primary document see N79-19365 10-37)
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Mathematical equations are presented for the following problems: (1) inviscid compressible flow, (2) heat addition to an ideal gas, (3) heat addition to a real gas, (4) laminar premixed flames, (5) turbulence, (6) turbulent premixed flames, (7) laminar diffusion flames, (8) turbulent diffusion flames, (9) stirred reactor concepts, (10) optimum burner design, (11) supersonic combustion, and (12) combustion noise. L.S.

N79-19378# Sheffield Univ. (England).
COMBUSTOR MODELLING
I. Poll, R. Payne, J. Swithenbank, and M. W. Vincent *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 12 p refs (For primary document see N79-19365 10-37)
(Grant USAF-2248-72)
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A modelling procedure is presented for the prediction of gas turbine combustor performance. The individual processes of fuel-spray evaporation, homogeneous turbulent mixing, and chemical reaction are combined by means of a partially stirred chemical reactor sequence representing the internal mean flow pattern derived from the geometry of a given combustor. Subsequent tests on the combustor showed satisfactory agreement between experimental and theoretical combustion extinction limits over a wide range of combustor loading. Since the reactor sequence depends on the geometry these results give confidence that this modelling technique can be applied at all normal operating conditions. L.S.

N79-19379# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
THE STIRRED REACTOR MODELLING OF A LOW POLLUTION, LIQUID FUELLED COMBUSTOR
D. S. Prior, J. Swithenbank, and P. G. Felton *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 11 p refs (For primary document see N79-19365 10-37)
(Grant AF-AFOSR-2682-74)
Copyright. Avail: NTIS HC A22/MF A01

The emission characteristics are presented of a liquid fuelled blue flame burner which may be incorporated in a two stage configuration for low pollution applications. A technique of predicting the emission performance of such devices is described and a general, heterogeneous, Well Stirred Reactor (WSR) analysis presented. This forms the basic component of a model for the blue flame burner which also employs a range of experimentally derived input information, a 17 step quasiglobal reaction mechanism and a network utilising 2 adiabatic WSR's. Reasonably good agreement between measured and predicted values of NO and CO emissions is obtained. L.S.

N79-19380# Rolls-Royce Ltd., Derby (England).
THE DESIGN AND DEVELOPMENT OF HIGH PERFORMANCE COMBUSTORS
A. B. Wassell *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 65 p refs (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

Design considerations for combustors have grown in importance, namely: Weight, Production Cost and Pollutant Emissions. The inter-relation between these factors are discussed in general terms, but most attention is focused on two factors which are critical in combustor development programmes for high duty systems - Linear Cooling and Combustor Outlet Temperature Distribution. The advent of pollution controls re-emphasised the need for minimising the quantity of air required for linear cooling and the operation at increasing turbine inlet temperature requires improvements in the pattern factor. Thus the accurate quantification of the pattern factor has become important. Past methods failed to define the pattern factor with sufficient accuracy, but new statistical appraisals of temperature distribution have been developed to enable them to be quantified with more precision. L.S.

N79-19381# Kraftwerk Union A.G., Mulheim (West Germany).
LARGE INDUSTRIAL CHAMBERS
O. Smoch *In* Von Karman Inst. for Fluid Dyn. Combust. Probl. in Gas Turbine Appl. 1977 76 p refs (For primary document see N79-19365 10-37)
Copyright. Avail: NTIS HC A22/MF A01

Some gas turbine manufacturers use large combustion chambers which are arranged in various ways beside the unit. They differ with respect to design and arrangement significantly from small combustion chambers. In particular, the individual components in large combustion chambers are confronted with a smaller heat load, enabling a longer life. Due to the fact that the dimensions with regard to the installation in the frame are not restricted, the unit can be designed in such a way that excellent combustion values as well as a flat temperature profile before turbine with relatively small power losses may be reached. From the operational point of view the design of large combustion chambers allows for the easy inspection of all the components in the hot area without the removal of large unit components.
Author

N79-19382# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INDUSTRIAL HEAT EXCHANGERS
1977 416 p refs Proc. of lectures held on 24-28 Jan., 1977 (VKI-Lecture-Series-94) Avail: NTIS HC A18/MF A01

Conductive and convective heat transfer, phase transformations, and the application of the number of transfer units method in the design of heat exchangers for industrial use are discussed. For individual titles, see N79-19383 through N79-19384.

N79-19383# Karlsruhe Univ. (West Germany). Dept. for Thermal Separation Processes.
[NOTES ON INDUSTRIAL HEAT EXCHANGERS]
H. Martin, E. U. Schluender, and A. Vogelpohl *In* Von Karman Inst. for Fluid Dyn. Ind. Heat Exchangers 1977 375 p refs (For primary document see N79-19382 10-37)
Copyright. Avail: NTIS HC A18/MF A01

The number of heat and mass transfer units (NTU) approach is reviewed and applied to the design of heat exchangers. Topics covered include (1) steady state and transient heating and cooling

of solids and fluids; (2) standard equations for heat transfer coefficients in conduction and convection; (3) limitations of the NTU concept in conduction and convection; (4) the mechanism of heat and mass transfer in heterogeneous systems with emphasis on fixed beds, bubble trays, and heat exchangers; (5) temperature distribution and heat exchange in multipass shell and tube exchangers with baffles; (6) fundamentals of heat transfer with boiling and evaporation; (7) boiling and evaporation in horizontal tubes; (8) condensation of vapors; (9) evaporation in the presence of inert gas in horizontal tubes, and (10) enhanced heat transfer for condensation and evaporation using fluted tubes and auxilliary circuits. A.R.H.

N79-19384# Stanford Univ., Calif. Dept. of Mechanical Engineering.

COMPACT HEAT EXCHANGERS

William K. Mays *In* Von Karman Inst. for Fluid Dyn. Ind. Heat Exchangers 1977 24 p refs (For primary document see N79-19382 10-37)

Copyright. Avail: NTIS HC A18/MF A01

The particular problems and opportunities that arise in the design and application of heat exchangers employing surface arrangements having the characteristic of very large amounts of surface heat transfer area per unit of volume are discussed. Relationships between the friction power expanded and the heat transferred are explored, and methods of improving the performance of heat exchanger surfaces are investigated from this point of view. Heat exchanger design theory, to the extent that it is applicable to very compact exchangers, is reviewed. Data are presented on the heat transfer and friction behavior of a number of very compact surfaces tested after the publication of the standard reference work on this subject. A.R.H.

N79-19385# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

INDUSTRIAL CENTRIFUGAL COMPRESSORS, VOLUME 1

1977 215 p refs Proc. of lectures held on 21-25 Feb. 1977 2 Vol.

(VKI-Lecture-Series-95) Avail: NTIS HC A10/MF A01

Flow modeling and design techniques for centrifugal compressors are discussed as well as the perspectives opened up by the application of boundary layer calculations. For individual titles, see N79-19386 through N79-19388.

N79-19386# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

FLOW MODELLING AND AERODYNAMIC DESIGN TECHNIQUES FOR CENTRIFUGAL COMPRESSORS

R. vandenBraembussche *In its* Ind. Centrifugal Compressors Vol. 1 1977 77 p refs (For primary document see N79-19385 10-37)

Copyright. Avail: NTIS HC A10/MF A01

The differences between industrial and advanced application centrifugal compressors are summarized. In comparison to axial flow compressors, the main difficulties for centrifugal compressors are the complexity of the flow and the complexity of the boundaries. The latter may be simplified by using one-dimensional approximations including incidence losses, friction, and eventual separation. Flow equations may be simplified by using quasi - or fully- three dimensional calculations of inviscid flow. Singularity conformal transformation, streamline curvature, finite difference, and finite element methods are used to follow a flow from inlet to diffuser outlet. The local behavior of the flow is discussed and relevant applicable design methods are examined. A.R.H.

N79-19387# Ecole Centrale de Lyon (France).

VISCOUS FLOWS IN CENTRIFUGAL COMPRESSORS

K. D. Papailiou *In* Von Karman Inst. for Fluid Dyn. Ind. Centrifugal Compressors, Vol. 1 1977 58 p refs (For primary document see N79-19385 10-37)

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Although the calculation of the flow in a radial compressor is actually realized on the basis of a quasi-three dimensional model which results from the superposition of two two-dimensional models, the flow in a radial compressor does not behave in this simple way. Factors that must be considered include the influence of the hub and tip wall shear layers; boundary layer separation and its behavior; and the effect of blade curvature and Coriolis effect on turbulence. The flow in the meridional plane is considered. Secondary flow behavior is calculated by averaging circonferentially the turbulent Navier-Stokes equations. The flow in the blade-to-blade plane is considered. Accurate calculations of separation and acceptable calculations of the separated boundary layer are obtained. The curvature and Coriolis effect are determined using an integral method of boundary layer calculation. A.R.H.

N79-19388# Societe Creusot-Loire, Paris (France). Div. Energie.

APPLICATION OF AERODYNAMIC DESIGN TECHNIQUES TO PROCESS COMPRESSOR DESIGN

J. M. Duchemin, J. Jehl, and M. Roustan *In* Von Karman Inst. for Fluid Dyn. Ind. Centrifugal Compressors, Vol. 1 1977 66 p refs (For primary document see N79-19385 10-37)

Copyright. Avail: NTIS HC A10/MF A01

The computing system developed at Creusot-Loire to accurately predict performances, upgrade existing machinery, and establish new designs is described. Some theoretical results and a comparison between performance testing and calculation are shown. Author

N79-19389# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

INDUSTRIAL CENTRIFUGAL COMPRESSORS, VOLUME 2

1977 335 p refs Proc. of lectures held on 21-25 Feb. 1977 2 Vol.

(VKI-Lecture-Series-95) Avail: NTIS HC A15/MF A01

Factors to be considered for optimal design and performance of turbocompressors are discussed with emphasis on thermodynamic properties and component configurations. For individual titles, see N79-19390 through N79-19393.

N79-19390# Gutehoffnungshuette Sterkrade A. G., Oberhausen (West Germany).

DESIGN OF MULTISTAGE COMPRESSORS WITH CONSIDERATION OF THE REAL BEHAVIOR OF GAS AND GAS MIXTURES

L. Turanskyj *In* Von Karman Inst. for Fluid Dyn. Ind. Centrifugal Compressors, Vol. 2 1977 102 p refs In BELORUSSIAN (For primary document see N79-19389 10-37)

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The thermodynamic equations of state provide the basis for correlations used to describe the p-v-T behavior of real gases and their mixtures. With the help of these equations, the enthalpy and entropy are determined and used in a design procedure to calculate multistage compressors. The design procedure is fundamentally explained. Problems involved in real gas behavior are considered in the prediction of the off-design behavior of multistage turbocompressors. Typical machines in practical service are described to indicate the variety of uses of modern turbocompressors. Author

N79-19391# Ruhr Univ., Bochum (West Germany).

A STRESS AND STRAIN ANALYSIS OF INDUSTRIAL RADIAL COMPRESSOR IMPELLERS USING THE FRAMEWORK METHOD

W. Fister and H. Heiderich *In* Von Karman Inst. for Fluid Dyn. Ind. Centrifugal Compressors, Vol. 2 1977 58 p (For primary document see N79-19389 10-37)

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The simplified strength analysis of impellers is based on classical computational methods of shell theory leading to the analytical solution of differential equations. However, the state of stress of the whole impeller, particularly the regions of maximum stress, are decisively influenced by the inherent strength of the blades. The blading arrangement and geometry must be considered according to the actual design. A computational procedure is described that makes possible an approximated strength determination of radial compressor impellers of an industrial geometry with and without a cover disk, and subjected to centrifugal forces. A.R.H.

N79-19392# Nuovo Pignone S.p.A., Florence (Italy).

DEVELOPMENT TESTING OF STAGES FOR CENTRIFUGAL PROCESS COMPRESSORS

E. Benvenuti *In* Von Karman Inst. for Fluid Dyn. Ind. Centrifugal

Compressors, Vol. 2 1977 130 p refs (For primary document see N79-19389 10-37)
Copyright. Avail: NTIS HC A15/MF A01

The features and capabilities of test rigs designed and set up for systematically testing industrial centrifugal compressor stages are discussed; and an outline of testing requirements and limitations associated with the use of results both for manufacturing design and for component development is given. Some types of instrumentation and particular equipment used in testing are described, and the complexity of flow fields existing in some relevant areas along the gas flowpath is shown, for evaluating measurement reliability and outlining some related component development problems. Test data reduction methods and correlation requirements are presented and the convenience of setting up standard stage series of known or reliably predictable performance is assessed. An example of agreement between predicted and experimental performance is shown for a multi-stage compressor consisting entirely of standard stages directly derived from tested configurations. A.R.H.

N79-19393# Creare, Inc., Hanover, N.H.
TURBOCHARGER DESIGN AND DEVELOPMENT
D. Japikse and J. Goebel *In* Von Karman Inst. for Fluid Dyn. Ind. Centrifugal Compressors, Vol. 2 1977 41 p refs (For primary document see N79-19389 10-37)
Copyright. Avail: NTIS HC A15/MF A01

Turbocharging diesel engines as a retrofit method of increasing maximum engine output usually result in better fuel economy. Turbocharger/engine system performance is examined and different matching issues are discussed. A sample turbocharger aerodynamic design is pursued through each design phase. Highlights of the aerodynamic technology base are presented. Topics covered in design optimization include impeller performance, vaneless and semivaneless space recovery, and channel diffuser recovery. A.R.H.

N79-19394# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MATERIALS RESEARCH FOR ADVANCED INERTIAL INSTRUMENTATION. TASK 2: GAS BEARING MATERIAL DEVELOPMENT BY SURFACE MODIFICATION OF BERYLLIUM Technical Report, 30 Sep. 1977 - 30 Jun. 1978
John R. Palmieri Sep. 1978 38 p
(Contract N00014-77-C-0388)
(AD-A061775; R-1199; TR-1) Avail: NTIS HC A03/MF A01 CSCL 13/9

Beryllium surfaces, such as used in inertial instrument gas bearings, are to be modified for improved friction and wear performance by case hardening with boron. Techniques being investigated are (1) high temperature reactive diffusion of the elements, and (2) low temperature ion implantation of boron into beryllium. Diffusion experiments to date have consisted of heating the solid elements in contact with each other under inert atmosphere at temperatures predicted by the Be-B phase diagram to avoid undesirable eutectic reactions. Of the two elements, beryllium has been used as a bulk solid and boron has been applied to its surface from a powder slurry, sputtered film, or bulk solid. Preliminary experiments have been done with CVD of boron from a commerical boronizing compound during induction heating under argon. Results indicate that a vapor source of boron may react differently as compared to a solid boron source with a beryllium substrate in that adherent compounds are formed. Ion implantation of boron into beryllium has been attempted. Initial beryllium flat specimens have had a concentration of 10 atomic percent boron implanted to a depth of approximately a micron. Annealing these specimens up to 650 C appears to have increased microhardness and resulted in a metallographic change resembling precipitation of a second phase. Analysis of this reaction is in progress. Higher concentrations of implanted boron (=30 atomic percent) are planned.
Author (GRA)

N79-19395# Air Force Packaging Evaluation Agency, Wright-Petterson AFB, Ohio.
PACKAGING AND HANDLING ANALYSIS OF A POLYETHYLENE, REUSABLE, LOW FRAGILITY, SHIPPING CONTAINER Final Report
Frank C. Jarvis Aug. 1978 36 p refs
(AD-A061757; AFPEA-78-P7-12; PTPT-78-18) Avail: NTIS HC A03/MF A01 CSCL 13/4

This study involved the evaluation of a low fragility shipping container (LFSC) developed by the Navy under contract with the Mercury Plastics Corporation to ship fragile avionics equipment. The Air Force Packaging Evaluation Agency (AFPEA) evaluated this pack (P/N 15024-200, NSN 01 016 3452) to determine if it was suitable for shipping fragile inertial guidance components. It was determined that this container would provide reasonable protection for fragile items if recommended procedures are followed regarding the positioning and securing of items on the load platform. This evaluation included low temperature (-40 F) drop test performance. Shock levels recorded in this study differed appreciable from those previously reported by the contractor but were still considered to be acceptable within limitations.
Author (GRA)

N79-19396# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
THERMOELASTIC AND DYNAMIC PHENOMENA IN SEALS Special Report, Jan. - Sep. 1978
Yih-Tsuen Wu and Ralph A. Burton Sep. 1978 49 p refs
(Contract N00014-75-C-0761)
(AD-A061754; Rept-5341-427-3) Avail: NTIS HC A03/MF A01 CSCL 21/5

An analysis of a seal model is made where the rotating element has both fixed tilt and two-lobe waviness. The stator is assumed to be gimbal mounted and to have inertial mass. Hydrodynamic lubrication is assumed, following the short bearing or narrow seal model. Conditions are examined where the stator precesses in synchronism with the rotor rotation. Particular interest is given to operating conditions where such behavior appears to degenerate. Author (GRA)

N79-19397# Westinghouse Research and Development Center, Pittsburgh, Pa.
INVESTIGATION OF WELD POOL STRUCTURE AND PROPERTY CONTROL IN PULSED ARC WELDING Annual Progress Report, 15 Sep. 1977 - 14 Sep. 1978
G. M. Ecer 31 Oct. 1978 79 p refs
(Contract N00014-77-C-0596)
(AD-A062063; Rept-78-9D4-PULSE-R1) Avail: NTIS HC A05/MF A01 CSCL 13/8

Initial findings on a study of the pulsed arc welding solidification structures are reported. Full penetration pulsed current gas tungsten arc welds in Fe-26Ni alloy sheets were dimensionally and structurally analyzed. Temperature profiles at various locations of several weldments were recorded and weld pool kinetics were studied using cinematography, conventional and scanning electron metallography. A two dimensional heat flow computer model of the pulsed arc welding was developed. Experimental data were comparatively analyzed against the early predictions of the model. Thermal conductivity and thermal diffusivity of the alloy, as well as heat transfer efficiency of the pulsed current GTAW process were estimated for use as computer input. In addition, melting efficiency of the process under various sets of pulsed welding variables was determined. Author (GRA)

N79-19398# Massachusetts Inst. of Tech., Cambridge. Surface Lab.
A STUDY OF HIGH SPEED FRICTION Final Report
Ernest Rabinowicz, Nam P. Suh, and Forest J. Carignan 30 Sep. 1978 139 p refs
(Contract DAAG29-76-C-0058)
(AD-A061913; ARO-14090.1-EX) Avail: NTIS HC A07/MF A01 CSCL 20/11

A high speed friction and wear machine has been developed for operation in the 100-500 feet per second regime. Normal loads up to ten pounds are used with the upper limit determined by the force transducer. Signals corresponding to the frictional and normal forces are electronically divided to indicate the friction coefficient. All data is recorded on a high speed oscillograph. Wear of test materials is determined by weight loss measurement. Interfacial temperature measurements via thermoelectric effects and optical pyrometry can be made. The apparatus and associated instrumentation is described in detail. Results indicate a decreasing friction coefficient with increasing sliding speed. This is due to thermal softening, leading to the presence of low shear films at the interface. However, full

hydrodynamic lubrication is not reached in the range of loads and velocities tested so the friction coefficient does not get below 0.14. The wear coefficient increases with sliding speed very rapidly. This is probably due to the change in hardness of the test materials at high temperatures. The following materials were tested against 4140 steel: 70-30 brass, gliding metal, copper, copper-16% lead, nylon, DQ3, Rulon A, vulcanized fiber, constantan, zinc, bismuth, Delrin, solder, grafite, iron, polycarbonate, polyethylene and woods metal. Author (GRA)

N79-19399# City Coll. of the City Univ. of New York. Dept. of Mechanical Engineering.
OPTIMIZATION OF STEP-UP GEAR TRAINS WITH DIFFERENT KINEMATIC PROFILES Final Report, 20 Nov. 1976 - 31 May 1978
Gerard G. Lowen 31 May 1978 315 p
(Grant DAAG29-77-G-0037)
(AD-A061862; ARO-14743.1-R-E) Avail: NTIS HC A14/MF A01 CSCL 13/9

It was the purpose of this project to provide the tools which allow efficiency comparisons between fuze related two and three pass step-up gear trains of different tooth geometries which are subject to operation in a spin environment. To this end mathematical models of such gear trains with both involute and ogival tooth shapes have been developed. These models allow, by way of moment input-output relationships, the determination of point and cycle efficiencies of the gear trains. Pivot friction, partly due to the centrifugal forces, is considered in addition to tooth contact friction. All models allow a wide variety of parameter changes. The appendices of this final report contain the derivations for the moment input-output relationships. GRA

N79-19400# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
SIMULATION OF NUMERICALLY CONTROLLED PRODUCTION MACHINING OPERATIONS USING GEMS (GENERALIZED MANUFACTURING SIMULATOR)
Ramon Goforth, C. L. Hough, and Don T. Phillips 1 Jun. 1978 48 p
(Grant NSF APR-76-22610)
(PB-288346/0; GEMS-8-78; NSF/RA-780263) Avail: NTIS HC A03/MF A01 CSCL 13H

The report discusses the methodology for creating micro-level simulation models of N/C processes using GEMS. Five basic single process scenarios of numerical control machining operations were created in order to illustrate the methods and concepts. The procedure for combining these single process models into multiple process models is also demonstrated by a two process, tool wear out example. The strategy for the creation of a micro-level N/C model involves the following steps: (1) subdivide all N/C cutting operations into generic time elements; (2) use the generic elements as building blocks for specific N/C operation process modules; (3) model a sequence of N/C operations by combining modules. The procedure for utilizing the output of the N/C micro-level simulation model as input data for a general macro-level model which simulates an entire processing line is also demonstrated. GRA

N79-19401# Calspan Corp., Buffalo, N. Y.
FRONT PASSENGER ASPIRATOR AIR BAG SYSTEM FOR SMALL CARS, PHASE 2 EVALUATION Final Report
David J. Romeo Mar. 1978 160 p refs
(Contract DOT-HS-5-01254)
(PB-288873/3; CALSPAN-ZP-5777-V-2; DOT-HS-803612) Avail: NTIS HC A08/MF A01 CSCL 13F

Development and evaluation of an aspirator air bag has been completed at Calspan Corporation. The aspirator air bag was developed through computer simulations and sled tests, Phase I, and was evaluated through additional sled tests and in a 41.6 mph crash of a standard Volvo in a flat barrier. This report reviews the Phase I development of the aspirator system and presents results of the Phase II sled tests and the car crash. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-19402*# Washington Univ., St. Louis, Mo. Dept. of Physics.
FURTHER DEVELOPMENT OF ULTRASONIC TECHNIQUES FOR NON-DESTRUCTIVE EVALUATION BASED ON FOURIER ANALYSIS OF SIGNALS FROM IRREGULAR AND INHOMOGENEOUS STRUCTURES Final Report
James G. Miller 30 Mar. 1979 26 p ref
(Grant NsG-1392)
(NASA-CR-158240) Avail: NTIS HC A03/MF A01 CSCL 14D

To investigate the use of Fourier analysis techniques model systems had to be designed to test some of the general properties of the interaction of sound with an inhomogeneity. The first models investigated were suspensions of solid spheres in water. These systems allowed comparison between theoretical computation of the frequency dependence of the attenuation coefficient and measurement of the attenuation coefficient over a range of frequencies. Ultrasonic scattering processes in both suspensions of hard spheres in water, and suspensions of hard spheres in polyester resin were investigated. The second model system was constructed to test the applicability of partial wave analysis to the description of an inhomogeneity in a solid, and to test the range of material properties over which the measurement systems were valid. G.Y.

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-19403 Northwestern Univ., Evanston, Ill.
STRESS INTENSITY FACTOR AND GROWTH OF A PLANAR CRACK SUBJECTED TO NORMAL PRESSURE Ph.D. Thesis
Efthimios Nikolaos Mastrojannis 1978 143 p
Avail: Univ. Microfilms Order No. 7903317

In order to study the growth of a planar crack subjected to normal stresses, knowledge of K sub I and of the crack-resistance characteristics of the material, which can be expressed by some critical level of K sub I denoted by K sub IC, is required. Given the value of the experimentally determined K sub IC, the growth process can be studied by knowing K sub I. Utilizing the formulation of the planar crack problem, the growth and arrest of an elliptical crack under uniform pressure, and of a penny-shaped crack under linearly varying pressure is investigated under the assumptions that the volume of the crack cavity remains constant during the growth process and that the normal distance through which each point on the crack edge moves outwards when K sub I > K sub IC is proportional to (K sub I - K sub IC)alpha, where alpha is some constant. Dissert. Abstr.

N79-19404 Lehigh Univ., Bethlehem, Pa.
A COMPOSITE OF TWO BONDED STRIPS CONTAINING PERPENDICULAR CRACKS AND AN INTERFACE CRACK Ph.D. Thesis
Ming-Che Lu 1978 180 p
Avail: Univ. Microfilms Order No. 7904311

The fracture problem of two bonded strips with an interface crack and cracks perpendicular to the interface is studied. The field equations for an elastic isotropic strip are transformed to give the displacement and stress expressions for each strip. A system of singular integral equations is obtained from the mixed boundary conditions. It is found that the system of singular integral equations is of the first kind for the problem without the interface crack and is of the second kind for the problem with the interface

crack. The singular behavior around each irregular point is studied by using Muskhelishvili's technique. The system of singular integral equations is solved numerically by using either a Gaussian integration formula or the weighted residual technique. The numerical results involving the stress intensity factors, the crack surface displacements, and the strain energy release rate are presented. Dissert. Abstr.

N79-19405 Stanford Univ., Calif.
ON THE STABILITY OF MOTION OF SYSTEMS SUBJECTED TO NONCONSERVATIVE LOADING Ph.D. Thesis
Charles Henry Spalding, III 1978 162 p
Avail: Univ. Microfilms Order No. 7905929

The equations of motion of the system were found to have periodic coefficients in general, so Floquet-type methods were used to perform the stability analysis. A modification of Floquet theory is presented which, when applicable, reduces by one-half the number of integrations of the linearized variational system that are required for stability behavior determination. As supplements to these methods for predicting when instabilities will occur, criteria are presented which enable prediction of the character of the unstable motions. It was found that, depending on certain parameter values, the system studied lost stability either by divergence or by flutter, and that the presence of motion had a stabilizing effect on both types of instabilities. As had been found previously for other systems, the presence of small damping had a destabilizing effect, but only with regard to flutter instabilities. Dissert. Abstr.

N79-19406 Purdue Univ., Lafayette, Ind.
SIMPLE MODELS FOR COMPUTING DYNAMIC RESPONSES OF COMPLEX FRAME STRUCTURES Ph.D. Thesis
Chun-Chieh Chen 1978 119 p
Avail: Univ. Microfilms Order No. 7905708

A simple shear beam model and a Timoshenko beam model were developed for dynamic analyses of complex frame structures. Explicit formulas were derived for computing the equivalent shear and bending rigidities in terms of the member dimensions and material properties of the original frame structure. The simple models are evaluated by comparing the simple model solutions with the solutions obtained from using full scale finite elements in free vibrations of plane frames. It is found that the simple models yield very accurate natural frequencies as well as mode shapes for the lower modes. Dissert. Abstr.

N79-19407 Iowa Univ., Iowa City.
PHYSICAL MECHANISMS IN THE AUTOCHRONIC THEORY OF PLASTIC DEFORMATION AND FATIGUE FAILURE Ph.D. Thesis
Chau-Fei Lee 1978 145 p
Avail: Univ. Microfilms Order No. 7902923

Physical mechanisms in the autochronic theory of plastic deformation and fatigue failure were identified as slip mechanisms. As a result, the autochronic theory was extended to include the constitutive formulation of metals with orthotropic, cubic and isotropic symmetries. Slip mechanisms, as a motivation of the autochronic theory of plasticity for polycrystalline metals, are justified on the basis that plastic deformation in metals is due to internal slip mechanisms. It is shown that an exact theory can be developed in the case of a single crystal. Dissert. Abstr.

N79-19408 Ohio State Univ., Columbus.
A PEAK-LOAD DESIGN CRITERION WITH APPLICATION TO THE RUPTURE OF SOLID CIRCULAR CYLINDERS OF STRAIN-HARDENING MATERIALS SUBJECTED TO A COMBINATION OF TENSION, TORSION AND SMALL BENDING MOMENT Ph.D. Thesis
Sulaeman Kamil 1978 180 p
Avail: Univ. Microfilms Order No. 7902154

The peak-load design criterion was applied to a circular cylinder subjected to mixed mode loadings. Both analytical and experimental rupture investigations were completed for tension combined with torsion. Also, an analytical rupture investigation for the case of tension combined with torsion and small bending moment was completed. An experimental setup, which was capable of applying tension and torque simultaneously, was designed and fabricated. A unique configuration of the specimen was invented for this rupture investigation. A force transducer, capable of measuring tension and torque simultaneously but independently, was designed, fabricated and was placed in series with the specimen. Dissert. Abstr.

N79-19409 Wisconsin Univ. - Madison.
TEMPERATURE BASED STRESS ANALYSIS OF NOTCHED MEMBERS Ph.D. Thesis
Eric Hopkins Jordan 1978 176 p
Avail: Univ. Microfilms Order No. 7820628

A stress analysis technique utilizing temperature data is developed. Temperatures are measured using thermocouple arrays welded directly to the specimen. Adiabatic temperature data are obtained by using rapid loading and rapid data collection. The temperature data are quantitatively related to mechanical variables using an equation based on known physics. The equation is verified in tests using unnotched specimens. Temperature change can be related to volume dilatation and/ or specific plastic work. Several distinct methods of using temperature data to distinguish elastic from plastic deformation are proposed and demonstrated. The technique is applied to the determination of plastic zone size within limitations imposed by the geometry and size of the zone being investigated. The technique is also used to evaluate the time-temperature dependence of stress relief in overloaded members of mild steel. Dissert. Abstr.

N79-19410 Maryland Univ., College Park.
TECHNIQUES FOR DYNAMIC FRACTURE TOUGHNESS MEASUREMENTS IN OPAQUE MATERIALS Ph.D. Thesis
Victor K. Der 1978 217 p
Avail: Univ. Microfilms Order No. 7903102

Three techniques for measuring dynamic fracture toughness in opaque materils are developed and validated. The methods developed for obtaining a crack velocity relationship with stress intensity factor are: (1) a birefringent coating technique, (2) a holographic interferometric technique using contours of principal stress sums (isopachic contours), and (3) a simplified method base on the initial stress intensity factor modified by correction terms to account for crack velocity effects and specimen/load fixture compliance interaction. Validation of these techniques is accomplished by comparing these test results of dynamic stress intensity factors with those determined by conventional dynamic photoelasticity on a material whose dynamic fracture behavior has been well characterized. Good agreement between these test results and those from the conventional photoelastic tests indicates that the techniques developed can be applied to other opaque materials of engineering interest. Dissert. Abstr.

N79-19411 California Univ., Berkeley.
THE SIZE EFFECT IN STATISTICAL FRACTURE Ph.D. Thesis
David Herbert Pankow 1978 133 p
Avail: Univ. Microfilms Order No. 7904350

The statistical prediction for the strength of a blunt notch is derived. Based on this derivation and the material structure, it is possible to predict the range of notch sharpness over which each approach is valid. Experimental data are presented to demonstrate this behavior. Assuming the flaw population to be an inherent property, smooth beam and notched beam tests are combined for a more thorough experimental examination of the flaw population than possible with previous methods. Limited data from tests of Alumina indicate that Weibull's empirical relation describes adequately the flaw population. Experimental data indicate that additional flaws are often created in processing and may strongly influence the mechanical behavior.
Dissert. Abstr.

N79-19412 Kansas Univ., Lawrence.
EXPERIMENTAL AND FINITE ELEMENT INVESTIGATION OF THE BUCKLING CHARACTERISTICS OF A BEADED SKIN PANEL FOR A HYPERSONIC AIRCRAFT Ph.D. Thesis
William Harry Siegel 1978 149 p
Avail: Univ. Microfilms Order No. 7904230

The project reported on involved the testing of a hypersonic beaded skin panel to failure. The primary interest was focused upon the buckling characteristics of the panel under pure compression with boundary conditions similar to those found in

a wing mounted condition. Three primary phases of analysis are included. These phases include: Experimental testing of the panel to failure; Finite element structural analysis of the beaded panel with the computer program NASTRAN; A summary of the semiclassical buckling equations for the beaded panel under purely compressive loads. A comparison of each of the analysis methods is also included. Dissert. Abstr.

N79-19413 Massachusetts Univ., Amherst.
FINITE ELEMENT ANALYSIS OF END PROBLEMS OF ORTHOTROPIC CYLINDERS Ph.D. Thesis
Nirmalya Bandyopadhyay 1978 132 p
Avail: Univ. Microfilms Order No. 7901972

A semi-analytical finite element method was developed for the solution of general asymmetric elastostatic end problems of orthotropic cylinders by eigensolution technique. The finite element equations for the semi-infinite cylinder are obtained from the potential energy expression assuming the solution to decay exponentially in the axial direction. The resulting quadratic matrix eigenvalue problem yields the decay parameters of the exponential solutions as eigenvalues. For finite cylinders, two sets of eigenfunctions together with zero eigenvalue solutions, if applicable, are superposed to satisfy the end conditions in a least square sense. Two cases of three dimensional flexure analysis of an orthotropic beam of hollow circular section were considered for illustration. The technique was then extended to the solution of an anisotropic strip with variable elastic properties. Accurate results were obtained using this technique which leads itself to easy programming in a digital computer. Dissert. Abstr.

N79-19414*# California Univ. at Los Angeles.
NONLINEAR EQUATIONS OF EQUILIBRIUM FOR ELASTIC HELICOPTER OR WIND TURBINE BLADES UNDERGOING MODERATE DEFORMATION Final Report
Avin Rosen and Peretz P. Friedmann Dec. 1978 104 p refs
(Grant NsG-3082; Contract E(49-26)-1028)
(NASA-CR-159478; UCLA-ENG-7718; DOE/NASA/3082-78/1) Avail: NTIS HC A06/MF A01 CSCL 20K

A set of nonlinear equations of equilibrium for an elastic wind turbine or helicopter blades are presented. These equations are derived for the case of small strains and moderate rotations (slopes). The derivation includes several assumptions which are carefully stated. For the convenience of potential users the equations are developed with respect to two different systems of coordinates, the undeformed and the deformed coordinates of the blade. Furthermore, the loads acting on the blade are given in a general form so as to make them suitable for a variety of applications. The equations obtained in the study are compared with those obtained in previous studies. L.S.

N79-19415*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASUREMENT OF TRANSIENT STRAIN AND SURFACE TEMPERATURE ON SIMULATED TURBINE BLADES USING NONCONTACTING TECHNIQUES
Frederick D. Calfo and Frank G. Pollack Aug. 1978 18 p refs
(NASA-TM-78982; C-9180) Avail: NTIS HC A02/MF A01 CSCL 20K

Noncontacting techniques were used to measure strain and temperature in thermally cycled simulated turbine blades. An electro-optical extensometer was used to measure the displacement between parallel targets mounted on the leading edge of the blades throughout a complete heating and cooling cycle. An infrared photographic pyrometry method was used to measure blade steady state surface temperature. The blade was cyclically heated and cooled by moving it into and out of a Mach 1 hot-gas stream. Transient leading edge strain and steady state surface temperature distributions are presented for blades of three different configurations. Author

N79-19416# Army Materials and Mechanics Research Center, Watertown, Mass.
BIAXIAL TESTING TECHNIQUES OF THIN-WALLED TUBULAR SPECIMENS Final Report
James J. Rainey, Ronald A. Swanson, and Shun-Chin Chou Sep. 1978 29 p
(DA Proj. 8X3-63304-D-215)
(AD-A061852; AMMRC-TR-78-37) Avail: NTIS HC A03/MF A01 CSCL 13/11

A biaxial testing technique of a thin-walled tubular specimen is described. The specimen was loaded with a combination of axial tension/compression and internal/external pressure. The technique can be used to test tubular specimens of any material. The yield surface of 2014-T651 aluminum was determined to illustrate the testing technique and data analysis. Author (GRA)

N79-19417# Georgia Inst. of Tech., Atlanta. School of Engineering Science and Mechanics.
THE EFFECT OF INITIAL IMPERFECTIONS ON OPTIMAL STIFFENED CYLINDERS UNDER TORSION Final Report, 1 Feb. 1974 - 31 Jan. 1978
George J. Simitses, Izhak Sheinman (Technion-Israel Inst. of Technology, Haifa), and Jagannath Giri Jan. 1978 109 p refs
(Grant AF-AFOSR-2655-74)
(AD-A062027; AFOSR-78-0787TR) Avail: NTIS HC A06/MF A01 CSCL 20/11

This report deals with the optimization of imperfect stiffened cylinders under destabilizing loads. The developed methodology is demonstrated through numerous examples. GRA

N79-19418# Lockheed-California Co., Burbank.
FRACTURE MECHANICS FOR STRUCTURAL ADHESIVE BONDS, PART 2, PHASE 2 Final Report, 1 Jul. 1977 - 30 Jun. 1978
T. R. Brussat, S. T. Chiu, and S. Mostovoy Aug. 1978 107 p refs
(Contract F33615-75-C-5224)
(AD-A061805; LR-28652-Pt-2; AFML-TR-77-163-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 13/5

Research results are presented of crack propagation tests and fracture mechanics analysis of laboratory joints and specimens bonded with FM-73 adhesive and containing bondline cracks. New baseline specimens and tests are developed, analyzed, and used for Mode I and mixed-mode fracture mechanics testing of adhesives. Baseline test data are reported for FM-73 including increasing load (fracture toughness) tests in laboratory air and sustained-load, hot-water-immersed tests. Results of fatigue crack growth tests are presented at two stress ratios, two environments, and three cyclic frequencies for three different baseline specimen geometries and three different mixes of Modes I and II. Fracture mechanics prediction methodology is demonstrated using results of nine da/dN tests of structural joint specimens immersed in hot water. Two different finite element analysis procedures are used to calculate strain energy release rate as a function of crack size. Then the baseline data enables crack growth rate estimation. Multiple cracking is considered based on measurements of final crack sizes on the fracture surfaces on the failed specimens. The estimated crack growth rates correlate well with the experimental data. Author (GRA)

N79-19419# Pennsylvania State Univ., University Park. Applied Research Lab.
THE EFFECTIVENESS OF SOME RECENT DAMPING TREATMENTS IN THE REDUCTION OF THE VIBRATION OF FLUID-LOADED FINITE PLATES M.S. Thesis
Richard Wells Thomas 4 Aug. 1978 91 p refs
(Contract N00017-47-C-14189)
(AD-A061943; TM-78-209) Avail: NTIS HC A05/MF A01 CSCL 20/11

The driving-point impedance of center-driven free square plates coated on one side by several commercially available damping treatments have been measured and compared with that of an uncoated, reference plate. The plates were subjected to two types of fluid loading: air loading of both sides, and water loading of the uncoated side. Comparison of the resonance frequencies and loss factors provided information about the effects of the damping treatments and the change in the fluid loading on the dynamic characteristics of the plates. Four damping treatments were tested. Of the damping treatments tested, LD400 and Embossed Foam Damping Sheet were found to be the most effective in reducing the vibrations of both the air loaded and water loaded plates. These treatments were seen to cause an increase in the resonant frequencies of the plates.

Measurements of the sound level in the direct field of the water loaded plates have shown that these two treatments caused the greatest reduction in the sound radiated by the plates. It is concluded that tile type damping treatments, such as LD400 and Embossed Foam Damping Sheet, are most effective in reducing plate vibrations and sound radiation. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N79-19420 Idaho Univ., Moscow.
ANALYSIS AND SPATIAL CLASSIFICATION OF MULTIVARIATE GEOLOGIC AND REMOTELY SENSED DATA USING EMPIRICAL DISCRIMINANT ANALYSIS Ph.D. Thesis
Kenneth Tillotson Meehan 1978 593 p
Avail: Univ. Microfilms Order No. 7904862

Statistical preprocessing narrowed the data base to a hybrid subset which then is used in further analysis to produce a geological component map. This map differed from the more conventional geologic map in that all spatial categories were a function of numerical information derived from various sources, including: (1) soil and stream sediment geochemistry, (2) aeromagnetic data, (3) Bouguer gravity values, (4) LANDSAT digital spectral data, (5) digitized linear parameters, and (6) documented mine/prospect qualitative data. The methods were designed to improve spatial classifications which previously relied on remotely sensed imagery alone. Extending the spectral signature to a physical signature by providing additional data types for the classifier was believed to be a step toward this goal. R-mode principal components factor analysis was applied to all variates for data reduction and provided insight into variable correlations. Dissert. Abstr.

N79-19421 Wisconsin Univ. - Madison.
THE INFLUENCE OF SHORT-PERIOD CLIMATIC VARIATIONS ON STREAMFLOW IN THE UNITED STATES AND SOUTHERN CANADA 1951-1970 Ph.D. Thesis
Patrick John Bartlein 1978 288 p
Avail: Univ. Microfilms Order No. 7823046

The principal objective of the research was to identify the atmospheric circulation anomalies that produce abnormal streamflow. The physical basis of the relationship between circulation and streamflow is the connection between circulation and surface weather. The pattern of the circulation in the mid and upper troposphere controls movements of air masses of differing qualities, and determines the distributions of storm systems and precipitation. Greater than normal precipitation usually occurs in regions downstream of troughs in the largescale circulation where stronger than normal airflow from moisture source regions, widespread ascension of air, and frequent storm systems occur. Not surprisingly, the spatial patterns of streamflow anomalies closely resemble the spatial patterns of precipitation anomalies. Dissert. Abstr.

N79-19422 Purdue Univ., Lafayette, Ind.
ANALYTICAL TECHNIQUES FOR THE STUDY OF SOME PARAMETERS OF MULTISPECTRAL SCANNER SYSTEMS FOR REMOTE SENSING Ph.D. Thesis
Eric Robert Wiswell 1978 199 p
Avail: Univ. Microfilms Order No. 7905799

Selection of a subset of spectral bands, the effects of differing spectral bandwidths, and signal-to-noise characteristics of spectral bands are some specific parameters considered. The parameters of interest in multispectral scanner systems tend to be dependent on the scene under observation. Furthermore, scenes exhibit randomness even with a specific scene type. The stochastic nature of scenes was modeled by considering the spectral response of a scene as a portion of a realization of a random process in wavelength. The observation made by a multispectral scanner system was then modeled as the spectral random process of the scene corrupted by an additive independent noise random process in wavelength. The concept of average mutual information in the received spectral random process about the spectral scene was developed for use in the study of the previously mentioned parameters. Dissert. Abstr.

N79-19423*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LEVEL 3 BASELINE: INFORMATION STORAGE, RETRIEVAL, AND REFORMATTING SUBSYSTEM (ISRRS) REQUIREMENTS, VOLUME 5, REVISION A
Nov. 1975 65 p Revised Sponsored by NASA, NOAA, and USDA EREP
(E79-10113; NASA-TM-79977; LACIE-C00200-Vol-5-Rev-A; JSC-0967-Vol-5-Rev-A) Avail: NTIS HC A04/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-19424*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). YES PHASE 1 YIELD FEASIBILITY REPORT
Jan. 1977 42 p refs Sponsored by NASA, NOAA, and USDA EREP
(E79-10121; NASA-TM-79985; LACIE-00439; JSC-11668) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. Each state model was separately evaluated to determine if a projected performance to the country level would satisfy a 90/90 criterion. All state models, except the North Dakota and Kansas models, satisfied that criterion both for district estimates aggregated to the state level and for state estimates directly from the models. In addition to the tests of the 90/90 criterion, the models were examined for their ability to adequately respond to fluctuations in weather. This portion of the analysis was based on a subjective interpretation of values of certain description statistics. As a result, 10 of the 12 models were judged to respond inadequately to variation in weather-related variables.

N79-19425*# National Oceanic and Atmospheric Administration, Columbia, Mo. Center for Climatic and Environmental Assessment
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). AN INDEX FOR ESTIMATING WHEAT YIELD IN AUSTRALIA
C. M. Sakamoto, Principal Investigator Houston, Tex. NASA Nov. 1977 40 p refs Sponsored by NASA, NOAA, and USDA EREP
(E79-10128; NASA-CR-158137; LACIE-00502; JSC-11699; CCEA-TN-76-3) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-19426*# National Oceanic and Atmospheric Administration, Columbia, Mo. Center for Climatic and Environmental Assessment.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). A WHEAT YIELD MODEL FOR PUNJAB, INDIA
Michael H. Procter and D. E. Umberger, Principal Investigators NASA Jan. 1978 34 p refs Houston, Tex. EREP
(E79-10129; NASA-CR-158138; LACIE-00505; JSC-11705; CCEA-TN-78-2) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-19427*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AGRICULTURAL SCENE UNDERSTANDING, VOLUME 1

Final Report 1, Dec. 1977 - 30 Nov. 1978
D. A. Landgrebe, Principal Investigator, Marvin E Bauer, Marilyn M. Hixson, Larry L. Biehl, Craig S. T. Daughtry, Barrett F. Robinson, and Eric R. Stoner Nov. 1978 115 p refs EREP
(Contract NAS9-15466)
(E79-10161; NASA-CR-160112; LARS-112578-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-19428*# Brevard County Health Dept., Titusville, Fla.
VEGETATION AND OTHER PARAMETERS IN THE BREVARD COUNTY BAR-BUILT ESTUARIES
Cherie Down and Richard Withrow, ed. Jun. 1978 90 p
(NASA-CR-158242; Rept-06-73) Avail: NTIS HC A05/MF A01 CSCL 06C

It is shown that low-altitude aerial photography, using specific interpretive techniques, can effectively delineate sea-grass beds, oyster beds, and other underwater features. Various techniques were used on several sets of aerial imagery. Imagery was tested using several data analysis methods, ground truth, and biological testing. Approximately 45,000 acres of grass beds, 2,500 acres of oyster beds, and 4,200 acres of dredged canals were mapped. This data represents selected sites only. Areas chosen have the highest quality water in Brevard County and are among the most highly recognized biologically productive waters in Florida. L.P.

N79-19429# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: OPEN MINING OF COAL. STATE OF THE ART Final Report, Sep. 1974 - Sep. 1977
S. J. Rusek, S. R. Archer, R. A. Wachter, and T. R. Blackwood Sep. 1978 90 p refs
(Contract EPA-68-02-1874)
(PB-288497/1; MRC-DA-709; EPA-600/2-78-004X) Avail: NTIS HC A05/MF A01 CSCL 13B

Atmospheric emissions from the open mining of coal were studied. The potential environmental effect of this emission source is evaluated using source severity, defined as the ratio of the maximum ground-level concentration of a pollutant at a respresentative plant boundary to a hazard factor. The hazard factor is the ambient air quality standard for criteria pollutants and an adjusted threshold limit value for other pollutants. Respirable dusts are generated from five unit operations and from wind erosion. GRA

N79-19430# Environmental Protection Agency, Corvallis, Oreg.
A COMPENDIUM OF LAKE AND RESERVOIR DATA COLLECTED BY THE NATIONAL EUTROPHICATION SURVEY IN THE CENTRAL UNITED STATES Final Report, 1974
Sep. 1978 202 p Prepared in cooperation with EPA, Las Vegas
(PB-288015/1; Working-Paper-476) Avail: NTIS HC A10/MF A01 CSCL 13B

Morphometric, limnological and nutrient loading data are summarized for 153 lakes and reservoirs studied during 1974 by the U.S. Environmental Protection Agency's National Eutrophication Survey. The water bodies for which data are summarized are located in the states of Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas. GRA

N79-19431*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 3 WORLD STANDARD CATALOG Monthly Report, 1-31 Jan. 1979
31 Jan. 1979 171 p
(GSFC/LWC/3-79/01; NTISUB/E/277-001) Avail: NTIS HC A08/MF A01 CSCL 05B

The World Standard Catalog lists imagery acquired by LANDSAT 3 which was processed and input to the data files during the referenced period. Information such as cloud cover and image quality is given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N79-19432*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2 WORLD STANDARD CATALOG, 1-31 JANUARY 1979
31 Jan. 1979 69 p
(NASA-TM-79996; GSFC/LWC/2-79/01; NTISUB/E/276-001) Avail: NTIS HC A04/MF A01 CSCL 05B

The World Standard Catalog lists imagery acquired by LANDSAT 2 which are processed and input to the data files during the referenced period. Information such as cloud cover and image quality is given for each scene. The microfilm roll and frame on which the scene may be found is also given. G.Y.

N79-19433# California Univ., Berkeley. Sanitary Engineering Research Lab.
FEASIBILITY OF RAINWATER COLLECTION SYSTEMS IN CALIFORNIA Final Technical Report
David Jenkins, Frank Pearson, Elizabeth Moore, Sun Jang Kim, and Richard Valentine Aug. 1978 65 p refs
(PB-288378/3; Contrib-173; UCAL-WRC-W-539; W79-00855) Avail: NTIS HC A04/MF A01 CSCL 13B

The feasibility of collecting rainwater for domestic consumption from roof areas into storage tanks was examined. Rainfall records for 13 representative California locations were analyzed to provide a basis for estimating the supply of water from rainwater collection systems. Standard statistical measures of central tendency, distribution and variation, as well as serial correlation, were remarkably consistent. The concentration of lead in rainwater near urban areas frequently exceeds the recommended limit for drinking water, which would imply that rainwater supply systems are feasible only in rural areas. Microbiological contamination of rainwater results from bird droppings on the collection area, but chlorine disinfection proved effective. GRA

N79-19434# California Univ., Davis. Dept. of Civil Engineering.
INTERFERENCES IN TRACE CONTAMINANT REMOVAL BY ADSORPTION FROM WATER FOR GROUNDWATER RECHARGE M.S. Thesis
Kevin Gerard McBride Dec. 1977 80 p refs Sponsored by the Office of Water Research and Technology, Washington, D. C.
(PB-288386/6; W79-00858) Avail: NTIS HC A05/MF A01 CSCL 13B

The central problem of this study is whether the advanced treatment of a waste stream containing phenolic compounds is feasible for the purpose of recharging to the groundwater. Removal of trace refractory organics requires use of a physicochemical method. Activated carbon adsorption is a suitable process choice because low level removals of most organic materials can be obtained, the process is inexpensive in comparison to other advanced treatment processes such as reverse osmosis and because considerable field experience has been gained. The project involves the adsorption of a domestic secondary effluent with a known addition of phenol onto activated carbon. Phenol was chosen as a specific contaminant because of its common abundance and its very low level discharge requirements. GRA

N79-19435# Alaska Univ., Fairbanks.
PROCEEDING OF THE MESA WORKSHOP ON PRINCE WILLIAM SOUND
Brenda Melteff, ed. May 1978 168 p Workshop held at Anchorage, Alaska, 7-9 Mar. 1978 Sponsored in part by EPA (Grant NOAA-SG-04-8-M01-49)
(PB-290116/3; Sea-Grant-78-9; NOAA78-121204) Avail: NTIS HC A08/MF A01 CSCL 13B

The Marine Ecosystem Analysis Program (MESA) of the National Oceanic and Atmospheric Administration has been considering undertaking an ecosystem study of Prince William Sound. As a preliminary step in this planning process, MESA contracted with the University of Alaska's Sea Grant Program to hold a workshop to define the present and foreseeable marine problems, projected development, user requirements and user conflicts in the Sound and its communities. Preliminary to the workshop, a planning meeting and community meetings were held. This report summarizes the results of those preliminary meetings and presents the data, discussions and conclusions reached during the workshop. GRA

N79-19436# Texas A&M Univ., College Station. Water Resources Sources Inst.
OPTIMAL OPERATION OF LARGE AGRICULTURAL WATERSHEDS WITH WATER QUALITY CONSTRAINTS
J. R. Williams and R. W. Hann, Jr. Apr. 1978 159 p refs Sponsored by Office of Water Research and Technology, Washington, D.C.
(PB-288942/6; TR-96; W79-01355; OWRT-A-999-TEX(6)) Avail: NTIS HC A08/MF A01 CSCL 13B

A number of models were developed for use in managing large agricultural watersheds to obtain maximum agricultural production and maintain water quality standards. Special attention was given to models simulating daily runoff and sediment, phosphorus, and nitrogen. Frequency relationships were determined for these parameters for small watersheds up to 40 sq km in area. A model was developed for routing sediment, phosphorus and nitrogen through streams and valleys of large watersheds with areas up to 2500 sq km and a problem-oriented computer language, SPNM, was developed for modeling sediment, phosphorus, and nitrogen yields. Another model, based on decision analysis and linear programming was developed to determine optimal operating policies for large watersheds. Strategies specifying the crop to be grown, fertilizer application rate, and type of conservation system were selected for each land class. GRA

N79-19437# Alaska Univ., Fairbanks. Inst. of Water Resources.
NUTRIENT CHEMISTRY OF A LARGE DEEP LAKE IN SUBARCTIC ALASKA Final Extramural Report
J. D. LaPerriere, T. Tilsworth, and L. A. Casper Sep. 1978 141 p refs
(Grant EPA-R-800276)
(PB-288979/8; EPA-600/3-78-088) Avail: NTIS HC A07/MF A01 CSCL 13B

The primary objective of this project was to assess the state of the water quality of Harding Lake, and to attempt to predict the effects of future development within its watershed. Since the major effect of degradation of water quality due to human activity is the promotion of nuisance growths of plants, the major emphasis was placed on measurements of plant growth and concentrations of the major nutrients they require. Planktonic algal growth was found to be low, below 95.6 gm/sq m/year, and the growth of submerged rooted plants was found to be relatively less important at approximately 1.35 gm/sq m/year. A model for predicting the effect of future real estate development in the watershed was modified and applied to this lake. This model adequately describes current water quality conditions. A secondary objective was to study the thermal regime of a deep subarctic lake. Hydrologic and energy budgets of this lake are given. Limited work on the zooplankton, fishes and benthic macroinvertebrates of this lake is also presented. GRA

N79-19438# Chesapeake Research Consortium, Inc., Annapolis, Md.
CHESAPEAKE BAY BASELINE DATA ACQUISITION. APPENDIX 9: WETLANDS ALTERATION Final Report, 1973-1978
Oct. 1978 240 p
(Contract EPA-68-01-3994)
(PB-289135/6; EPA-903/9-78-028) Avail: NTIS HC A11/MF A01 CSCL 06F

Researchers conducting current research programs relating to wetland alterations in the Chesapeake Bay estuarine system were identified. The data files were compiled from the Environmental Data Base Directory and reflected data applicable to wetland alterations from 1973 to the present. The major past, present, or planned monitoring effects were considered. The data will aid in the design of future research and monitoring efforts for the Chesapeake Bay. GRA

N79-19067*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LS47: A DSN STATION LOCATION SET COMPATIBLE WITH JPL DEVELOPMENT EPHEMERIS DE108
J. Ellis *In its* The Deep Space Network 15 Feb. 1979 p 86-98 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 08B

N79-19986# Joint Publications Research Service, Arlington, Va.
OPTICAL-MECHANICAL SCANNERS FOR EARTH OBSERVATION
A. S. Selivanov, V. P. Chemodanov, B. A. Suvorov, M. K. Narayeva, I. F. Sinelnikova, R. S. Bondarenko, and V. I. Seregin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 61 (JPRS-72988) 13 Mar. 1979 p 31-39 refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), no. 6, 1978 p 17-21 (For primary document see N79-19983 10-99)
Avail: NTIS HC A04/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-19439 Johns Hopkins Univ., Baltimore, Md.
SOLAR HEATING OF BUILDINGS: DESIGN OPTIMIZATION AND ECONOMIC ANALYSIS Ph.D. Thesis
Arthur Edwin McGarity 1979 163 p
Avail: Univ. Microfilms Order No. 7906470

The problem of the design and economic analysis of solar heated buildings is treated as a multivariable optimization problem involving collector area, storage volume, and heating load reduction as decision variables. A mathematical programming optimization model employing a hybrid basic descent method is developed and is used to generate optimal area-volume paths which describe the cost minimizing combinations of collector area and storage volume for solar space heating systems which provide various fractions of the heating load (solar fractions). Dissert. Abstr.

N79-19440 Stanford Univ., Calif.
ALTERNATIVE MODELS OF ENERGY DEMAND Ph.D. Thesis
Sergio Granville 1978 169 p
Avail: Univ. Microfilms Order No. 7905870

The relationship between three aggregate inputs to the U.S. economy: value added by capital and labor, electric energy, and nonelectric energy was studied. The analysis consisted of an attempt to obtain improved econometric estimates of two demand elasticity parameters: the elasticity of substitution between energy and value added and the elasticity of substitution between electric and nonelectric energy. The short-run forecasting performance and the energy policy implications of the three alternative sets of demand elasticity parameters were examined. Dissert. Abstr.

N79-19441 Ohio State Univ., Columbus.
LIQUID PHASE EPITAXIALLY GROWN HOMOJUNCTIONS IN GALLIUM ALUMINUM ARSENIDE FOR SOLAR CELL APPLICATIONS Ph.D. Thesis
Ward James Collis 1978 170 p
Avail: Univ. Microfilms Order No. 7902102

The liquid phase epitaxial process was used to fabricate p-n junctions in Ga sub 1-x Al sub x As, where x is approximately equal to 0.1-0.2. A horizonal slider system with two melts was utilized to sequentially deposit nGaAlAs and pGaAlAs upon nGaAs substrates. The resulting structure has applications in solar cells operating at high temperatures and high isolations, and as one of the junctions in a multijunction cascade solar cell. Hall measurements were performed on single layers of the GaAlAs alloys at 298 and 77 K. Current-voltage characteristics of the p-n GaAlAs homojunction yielded 1 varies as exp(qV/A sub 1 kt)over a portion of the measurement range, with A sub 1 approximately equal to 2. This suggest that the current is predominantly due to recombination within the space charge region. Dissert. Abstr.

N79-19442 Massachusetts Univ., Amherst.
ENERGY ANALYSES APPLIED TO OCEAN THERMAL ENERGY CONVERSION AND AN OFFSHORE WIND POWER SYSTEM Ph.D. Thesis
Tage Carl Gerald Carlson 1978 167 p
Avail: Univ. Microfilms Order No. 7901982

The primary concern for the dwindling fossil energy supplies in this country has led to an increased use of energy analyses and large scale energy modeling as a major input to energy policy decisions. Currently the more prominent energy analyses used are; net energy analysis, dynamic energy analysis, input-output matrix analysis, and second law of thermodynamics analysis. In addition, four large scale energy models were also generated. Each of the modes and analyses are explained and examined with a comparison and critique given on each. It is concluded that at the present time, no single energy analysis technique or model will provide all the necessary information on which an energy policy decision can be based. Dissert. Abstr.

N79-19443 Columbia Univ., New York.
OPTIMIZATION IN ENERGY REGENERATION Ph.D. Thesis
Chun-Keung Sydney Chu 1978 146 p
Avail: Univ. Microfilms Order No. 7904068

Significant energy conservation can be achieved through implementation of regenerative braking for a subway system. In the context of natural receptivity, regenerated energy may be used to apply the power need of nearby trains. This recovered energy is a fraction of the total potentially available energy for recovery, and is schedule as well as system characteristics dependent. A mathematical model for energy regeneration is formulated. Effective energy usage is defined to be the total traction energy input less the total energy regenerated for eventual recovery. Minimization of effective energy usage is examined and optimal modes of operation of individual trains between stations are derived for various degrees of regeneration. These methods can be extended to cover trips of longer duration.
Dissert. Abstr.

N79-19444 California Univ., Berkeley.
EVALUATION OF THE USE OF OXYGEN AS OXIDANT IN FOSSIL FUEL FIRED OPEN CYCLE MHD-STEAM ENERGY CONVERSION PROCESSES Ph.D. Thesis
Habib Amin 1978 121 p
Avail: Univ. Microfilms Order No. 7904362

The thermodynamics and economics of using oxygen versus air as the oxidant in large coal-fired MHD-steam energy conversion plants were evaluated and compared. Coal burned with oxygen produces combustion gases of very high temperature and of relatively high electrical conductivity. As a result of the reduction in gas flow that is a consequence of combustion with oxygen, there are significant reductions in the sizes and costs of required preheaters, MHD ducts, and superconducting magnets. Furthermore, combustion with high parity oxygen minimizes air pollution problems related to the conversion of molecular nitrogen oxides. The reduction in SO2 and particulates control costs as a result of the decrease in combustion gas flow rate is analyzed. The major disadvantage of coal combustion with oxygen is found to be the energy and capital cost required for the oxygen plant. Throughout the study, the advantages and disadvantages of using oxygen are evaluated and compared for selected power generation systems. Dissert. Abstr.

N79-19445 California Univ., Berkeley.
V-GROOVE MULTIJUNCTION SOLAR CELLS Ph.D. Thesis
Terry Ivan Chappell 1978 130 p
Avail: Univ. Microfilms Order No. 7904404

A study of three components which can be used in a solar utilization system are described. The three components are: a photovoltaic converter, an intensity sensor, and a selective thermal absorber. The results of extensive computer simulations, theoretical analyses, and measurements are reported for these components. A new family of silicon photovoltaic devices called V-Groove Multi-Junction (VGMJ) solar cells are described. The details of the fabrication for the Type 6 VGMJ solar cells is also described. The design of a silicon sensor intended for use in rapid-scan solar flux mapping at high illumination intensities is discussed. The characteristics of a water absorber in front of a silicon solar cell are quantified through the use of computer simulations and measurements. Dissert. Abstr.

N79-19446 Massachusetts Univ., Amherst.
TWO-DIMENSIONAL ANALYSIS OF VERTICAL AXIS WINDMILLS Ph.D. Thesis
Edward S. VanDusen 1978 296 p
Avail: Univ. Microfilms Order No. 7903857

A two-dimensional inviscid flow model is developed for vertical axis windmills with two foils of arbitrary shape. The solution is in the reference frame of the rotating foils and includes a time developing wake as vorticity is shed from the trailing edge of each foil. The results from different time steps, hence rotor orientations, are presented as plots of torque, streamlines, and power coefficient over a wide range of tip speed ratios. A heuristic stall model to account for flow separation is included in a manner that anticipates future viscous analysis. Results investigating the time step between solutions and different geometries are presented and compared to empirical values. Dissert. Abstr.

N79-19447* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR CELL MODULE ASSEMBLY JIG Patent
Herbert W. OFarrell, inventor (to NASA) (TRW Inc., Redondo Beach, Calif.) Issued 26 Jul. 1966 8 p Filed 10 Jun. 1963 (NASA-Case-XGS-00829-1; US-Patent-3,262,694; US-Patent-Appl-SN-286824; US-Patent-Class-269-153) Avail: US Patent and Trademark Office CSCL 10A

The invention relates to the manufacture of solar cell modules and more particularly to a jig for assembling, positioning and maintaining the components under resilient pressure, while the entire assembly and the jig is subjected to heat for simultaneously soldering all of the various circuit connections; as well as structurally bonding the layers into a strong light weight structure which minimizes the tendency of the solar cells to crack and the other components and electrical connections to fracture.
Official Gazette of the U.S. Patent and Trademark Office

N79-19448*# RCA Labs., Princeton, N. J.
EPITAXIAL SOLAR-CELL FABRICATION, PHASE 2 Final Report, 11 Nov. 1974 - 10 Jun. 1977
R. V. Daiello, P. H. Robinson, and H. Kressel Nov. 1977 75 p refs
(Contract NAS3-19401)
(NASA-CR-135350; PRRL-77-CR-46) Avail: NTIS HC A04/MF A01 CSCL 10A

Dichlorosilane (SiH2Cl2) was used as the silicon source material in all of the epitaxial growths. Both n/p/p(+) and p/n/n(+) structures were studied. Correlations were made between the measured profiles and the solar cell parameters, especially cell open-circuit voltage. It was found that in order to obtain consistently high open-circuit voltage, the epitaxial techniques used to grow the surface layer must be altered to obtain very abrupt doping profiles in the vicinity of the junction. With these techniques, it was possible to grow reproducibly both p/n/n(+) and n/p/p(+) solar cell structures having open-circuit voltages in the 610- to 630-mV range, with fill-factors in excess of 0.80 and AM-1 efficiencies of about 13%. Combinations and comparisons of epitaxial and diffused surface layers were also made. Using such surface layers, we found that the blue response of epitaxial cells could be improved, resulting in AM-1 short-circuit current densities of about 30 mA/cm sq. The best cells fabricated in this manner had AM-1 efficiency of 14.1%.
L.S.

N79-19449*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRIMARY LITHIUM BATTERY TECHNOLOGY AND ITS APPLICATION TO NASA MISSIONS
H. A. Frank 15 Feb. 1979 30 p refs
(Contract NAS7-100)
(NASA-CR-158229; JPL-Pub-79-6) Avail: NTIS HC A03/MF A01 CSCL 10C

A description is given of the components, overall cell reactions, and performance characteristics of promising new ambient temperature lithium primary systems based on the Li-V205, Li-SO2, and Li-SOC12 couples. Development status of these systems is described in regard to availability and uncertainties in the areas of safety and selected performance characteristics.

Studies show that use of lithium batteries would enhance a variety of missions and applications by decreasing power sytems weight and thereby increasing payload weight. In addition, the lithium batteries could enhance cost effectiveness of the missions. G.Y.

N79-19450*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BIOCONVERSION STUDY CONDUCTED BY JPL
John Kalvinskas 15 Nov. 1978 124 p refs
(Contract NAS7-100)
(NASA-CR-158228; JPL-Pub-79-9) Avail: NTIS HC A06/MF A01 CSCL 10A

The Jet Propulsion Laboratory (JPL) of Caltech conducted a study of bioconversion as a means of identifying the role of biomass for meeting the national energy fuel and chemical requirements and the role and means for JPL-Caltech involvement in bioconversion. The bioconversion study included the following categories; biomass sources, chemicals from biomass, thermochemical conversion of biomass to fuels, biological conversion of biomass to fuels and chemicals, and basic bioconversion sciences. A detailed review is included of the bioconversion fields cited with specific conclusions and recommendations given for future research and development and overall biomass system engineering and economic studies. Author

N79-19451*# Technical Marketing Associates, Inc., Concord, Mass.
MARKET DEFINITION STUDIES FOR PHOTOVOLTAIC HIGHWAY APPLICATIONS
Dec. 1978 121 p
(Contracts DEN-3-40; DE-A101-79ET20485)
(NASA-CR-159477; DOE/NASA/0040-78/1) Avail: NTIS HC A06/MF A01 CSCL 10A

Prospects for solar electric power in applications related to highways within the continental United States are examined. Principal prospective users are found to be the highway departments of the various states. Economic analysis is employed to demonstrate that suitable applications can occur when powering apparatus such as signs, crossing signals, or instruments which consume less than 100 watts on the average, provided they are located at least one-half mile from existing utility power. Such applications are projected to occur two or three times per state per year. Attitudes of highway officials toward possible use of solar power are sampled and described. Although falling photovoltaic cell prices are expected to have little effect on sales potential here, methods for federal stimulation of this market are discussed. G.Y.

N79-19452*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
A THEORETICAL STUDY OF HETEROJUNCTION AND GRADED BAND GAP TYPE SOLAR CELLS Final Report
J. P. C. Chiang and J. R. Hauser Mar. 1979 51 p refs
(Grant NsG-1116)
(NASA-CR-158232) Avail: NTIS HC A04/MF A01 CSCL 10A

The work performed concentrated on including multisun effects, high temperature effects, and electron irradiation effects into the computer analysis program for heterojunction and graded bandgap solar cells. These objectives were accomplished and the program is now available for such calculations. M.M.M.

N79-19453*# Honeywell, Inc., Minneapolis, Minn.
PRELIMINARY DESIGN PACKAGE FOR RESIDENTIAL HEATING/COOLING SYSTEM: RANKINE AIR CONDITIONER REDESIGN
Dec. 1978 109 p Prepared for DOE
(Contract NAS8-32093)
(NASA-CR-150871) Avail: NTIS HC A06/MF A01 CSCL 10A

A summary of the preliminary redesign and development of a marketable single family heating and cooling system is presented. The interim design and schedule status of the residential (3-ton) redesign, problem areas and solutions, and the definition of plans for future design and development activities were discussed. The proposed system for a single-family residential heating and cooling system is a single-loop, solar-assisted, hydronic-to-warm-air heating subsystem with solar-assisted domestic water heating and a Rankine-driven expansion air-conditioning subsystem. Author

N79-19454*# Comstock and Wescott, Inc., Cambridge, Mass.
DEVELOPMENT OF A PHASE-CHANGE THERMAL STORAGE SYSTEM USING MODIFIED ANHYDROUS SODIUM HYDROXIDE FOR SOLAR ELECTRIC POWER GENERATION
Barry M. Cohen, Richard E. Rice, and Peter E. Rowny Dec. 1978 252 p refs Prepared for DOE
(Contracts NAS3-20615; EC-77-A-31-1034)
(NASA-CR-159465; DOE/NASA/0615-79/1) Avail: NTIS HC A12/MF A01 CSCL 10A

A thermal storage system for use in solar power electricity generation was investigated analytically and experimentally. The thermal storage medium is principally anhydrous NaOH with 8% NaNO3 and 0.2% MnO2. Heat is charged into storage at 584 K and discharged from storage at 582 K by Therminol-66. Physical and thermophysical properties of the storage medium were measured. A mathematical simulation and computer program describing the operation of the system were developed. A 1/10 scale model of a system capable of storing and delivering 3.1 x 10 to the 6th power kJ of heat was designed, built, and tested. Tests included steady state charging, discharging, idling, and charge-discharge conditions simulating a solar daily cycle. Experimental data and computer-predicted results are correlated. A reference design including cost estimates of the full-size system was developed. Author

N79-19455*# Copper Development Association, Inc., New York, N. Y.
FINAL SYSTEM INSTRUMENTATION DESIGN PACKAGE FOR DECADE 80 SOLAR HOUSE
Dec. 1978 69 p refs
(Contract NAS8-32244)
(NASA-CR-150869) Avail: NTIS HC A04/MF A01 CSCL 10A

The final configuration of the Decade 80 solar house to monitor and collect system performance data is presented. A review demonstrated by actual operation that the system and the data acquisition subsystem operated satisfactorily and installation of instrumentation was in accordance with the design. This design package is made up of (1) site and system description, (2) operating and control modes, and (3) instrumentation program (including sensor schematic). M.M.M.

N79-19456*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
DEVELOPMENT OF LOW COST CONTACTS TO SILICON SOLAR CELLS Quarterly Report, 15 Oct. - 31 Dec. 1978
P. A. Iles and D. P. Tanner 31 Dec. 1978 50 p refs
(Contract JPL-955244)
(NASA-CR-158352; DOE/JPL-955244-79/1; QR-1) Avail: NTIS HC A03/MF A01 CSCL 10A

Commercial electroless Cu solutions were used. Satisfactory adhesion (and fairly good cell performance) resulted from the use of thin layers of barrier metals such as Au, Cr or Pd. In these tests, photoresist masks were used to contact silicon P-type slices with diffused N+ and alloyed P+ surfaces; and electrolytic Cu solution was used to build up the contact thickness to provide good cell behavior. In addition some cells with evaporated Cr-Cu contacts were also made (along with evaporated Ti-Pd-Ag contacts as controls), with the intention of subjecting cells to gradually increasing heat-treatments, to determine whether Cu causes the cells to be inherently unstable. L.P.

N79-19457*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRUCTURAL ALIGNMENT SENSOR FEASIBILITY DEMONSTRATION Final Report
R. H. Anderson, C. C. Huang, and J. R. Hodor [1978] 43 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955130)
(NASA-CR-158353; LMSC-D644951) Avail: NTIS HC A03/MF A01 CSCL 10A

A structural alignment sensor (SAS) was developed for use with large deployable antenna systems for contour measurement and/or active control. The SAS is a laser ranging system using

frequency modulation and accurate phase measurement to determine distance. Work was done with a CO2 and HeNe laser. The capability of the SAS to measure antenna rib contours was studied over ranges of 50 meters to a resolution of 100 microns. Initial resolution data was taken with the CO2 system. This data shows that it will indeed meet the SAS requirements. The development of the HeNe system was initiated because it offers substantial improvement in size, weight, and power over the CO2 system. The final demonstration was made with the HeNe system and it too showed that the SAS requirements could be met with this alternate approach. The projection of these results to a conceptual design for a flight system and its application are described. M.M.M.

N79-19458*# Florida Univ., Gainesville. Dept. of Electrical Engineering.
STUDIES OF SILICON PN JUNCTION SOLAR CELLS Final Technical Report
Fredrik A. Lindholm and Arnost Neugroschel Sep. 1977 88 p refs
(Grant NsG-3018)
(NASA-CR-158173; TR-77-1) Avail: NTIS HC A05/MF A01 CSCL 10A

Modifications of the basic Shockley equations that result from the random and nonrandom spatial variations of the chemical composition of a semiconductor were developed. These modifications underlie the existence of the extensive emitter recombination current that limits the voltage over the open circuit of solar cells. The measurement of parameters, series resistance and the base diffusion length is discussed. Two methods are presented for establishing the energy bandgap narrowing in the heavily-doped emitter region. Corrections that can be important in the application of one of these methods to small test cells are examined. Oxide-charge-induced high-low-junction emitter (OCI-HLE) test cells which exhibit considerably higher voltage over the open circuit than was previously seen in n-on-p solar cells are described. A.R.H.

N79-19459*# Solarex Corp., Rockville, Md.
DEVELOPMENT OF AN IMPROVED HIGH EFFICIENCY THIN SILICON SOLAR CELL Quarterly Report
C. Wrigley and G. Storti Jul. 1978 10 p
(Contracts NAS7-100; JPL-954883)
(NASA-CR-158172; SX/115/3Q; QR-3) Avail: NTIS HC A02/MF A01 CSCL 10A

Efforts were directed towards investigating means of producing more effective high-low junctions at the back of the cell. Cells with output power up to 77 mW (AM0 efficiency of 14.2 percent) were fabricated. Some reflectivity studies were also made. Deliveries of 2 cm x 2 cm experimental cells included a number having AM0 outputs greater than 70 mW. L.S.

N79-19460*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL AND OTHER TESTS OF PHOTOVOLTAIC MODULES PERFORMED IN NATURAL SUNLIGHT
J. W. Stultz 31 Jul. 1978 58 p refs Sponsored by NASA and DOE
(NASA-CR-158174; JPL-5101-76; DOE/JPL-1012-78/9) Avail: NTIS HC A04/MF A01 CSCL 10A

The bulk of the testing was the characterization of twenty-nine modules according to their nominal operating cell temperature (NOCT) and the effect on NOCT of changes in module design, various residential roof mounting configurations, and dirt accumulation. Other tests, often performed parallel with the NOCT measurements, evaluated the improvement in electrical performance by cooling the modules with water and by channeling the waste heat into a phase change material (wax). Electrical degradation resulting from the natural marriage of photovoltaic and solar water heating modules was also demonstrated. Cost effectiveness of each of these techniques are evaluated in light of the LSA cost goal of $0.50 per watt. L.S.

N79-19461# Council on Environmental Quality, Washington, D.C.
THE GOOD NEWS ABOUT ENERGY
1979 64 p refs
Avail: NTIS MF A01; SOD HC

A project was undertaken to investigate the potential for achieving lower energy growth in the United States and the implications of this low energy growth for the economy, the environment and government policy. The overall conclusion is that the United States can do well, indeed prosper, on much less energy than has been commonly supposed. The principal basis for this is the accumulating evidence that the means are available to wring far more consumer goods and services out of each unit of fuel that is used, whether it be a barrel of oil or a ton of coal or uranium. L.S.

N79-19462*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LSA LOW-COST SOLAR ARRAY PROJECT Quarterly Report, Oct. - Dec. 1977
Dec. 1977 76 p Sponsored by NASA and DOE
(NASA-CR-158250; JPL-5101-81; QR-7; DOE/JPL-1012-78/13; JPL-Pub-78-97) Avail: NTIS HC A05/MF A01 CSCL 10A

The activities of the Low-Cost Silicon Solar Array Project during the period October through December, 1977 are reported. The LSSA Project is assigned responsibility for advancing silicon solar array technology while encouraging industry to reduce the price of arrays to a level at which photovoltaic electric power systems will be competitive with more conventional power sources early in the next decade. Set forth are the goals and plans with which the Project intends to accomplish this and the progress that was made during the quarter. G.Y.

N79-19463# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
AN INDICATOR FOR THE DETECTION OF SULPHUR DIOXIDE FROM CELLS AND BATTERIES Final Report, Mar. - May 1978
James S. Cloyd Oct. 1978 20 p ref
(AD-A062031; AFAPL-TR-78-79) Avail: NTIS HC A02/MF A01 CSCL 10/3

This report presents the results of the experimentation for the development of a chemical indicator for use in the detection of sulfur dioxide. This indicator has application for use with lithium-sulfur dioxide cells/batteries and with cells and batteries in which thionyl chloride or sulfuryl chloride is used as the active cathode. A depletion or sulfur dioxide from a lithium-sulfur dioxide cell of battery with subsequent use may produce unsafe conditions for the user. Both thionyl and sulfuryl chloride undergo hydrolysis in ambient humidity and produce amounts of sulfur dioxide. This indicator can be used as a warning device for leakage or venting in these types of cells and batteries and consists of potassium chromate adsorbed onto a silicon powder with subsequent suspension in a silicon rubber material. Author (GRA)

N79-19464# Naval Research Lab., Washington, D. C.
RESULTS OF THE SOLAR CELL EXPERIMENTS ON THE NTS-2 SATELLITE AFTER 223 DAYS IN ORBIT Memorandum Report, Jun. 1976 - Apr. 1978
Delores H. Walker Sep. 1978 33 p refs
(AD-A061857; NRL-MR-3860) Avail: NTIS HC A03/MF A01 CSCL 10/2

Results after 223 days in orbit of the solar cell experiments aboard the NTS-2 satellite are presented. The objective of the solar cell experiment, consisting of fifteen (15) separate experiments of five cells each, is to evaluate the performance of state-of-the-art solar cells in the space environment. These experiments will answer questions that have arisen from the previous NTS-1 solar cell experiments such as: the need for ultraviolet rejection filters in space solar cell systems, space qualification of electrostatic bonding techniques for solar cell converslides, and the improved efficiency to be realized from the use of texture cell surfaces. In addition, a gallium arsenide (GaA1As/GaAs) solar cell module is being flight tested. The average value of I(sc) measured in space on the first day of exposure agreed with solar simulator values to within 1.41 - or - 0.99 percent. The agreement between Voc in space with solar simulator values was 1.24 - or - 1.08 percent. After 223 days in orbit, the loss in power ranged from 4.6 percent to 46.5 percent with the exception of the Solarex 'low-cost space cell' which became open-circuited on the 69th day. Results are given of the changes in the photovoltaic parameters of each of the experiments. Author (GRA)

N79-19465# Case Western Reserve Univ., Cleveland, Ohio. Plasma Research Lab.

THEORETICAL AND EXPERIMENTAL STUDY OF SUPERCONDUCTING INDUCTIVE STORAGE SYSTEMS Final Report, Aug. 1976 - Jul. 1978

O. K. Mawardi, D. Hazony, H. K. Chung, and Leo D. Holland Oct. 1978 128 p refs

(Grant AF-AFOSR-2886-76)

(AD-A062078; AFOSR-78-1500TR) Avail: NTIS HC A07/MF A01 CSCL 10/3

This report covers a two year effort to develop efficient pulse inductive storage sources. Two schemes have been considered in detail. One scheme is based on the electromagnetic dual of the classic Marx generator. In the other scheme a pulse shaping circuit has been used to improve the energy transfer from the storage to the load. In the process of these investigations two types of flux pumps have been investigated. These superconducting devices are ideal to provide the charging current to the inductors. Fast acting pumps were designed and built. Their response is several orders of magnitude better than is currently available. Author (GRA)

N79-19466*# Spire Corp., Bedford, Mass.

LOW TEMPERATURE FABRICATION OF HIGH EFFICIENCY SILICON SOLAR CELLS Final Technical Report, Feb. 1976 - Jun. 1978

Allen R. Kirkpatrick, John A. Minnucci, and Anton C. Greenwald Aug. 1978 86 p refs

(Contract F33615-75-C-2006)

(AD-A061956; AFAPL-TR-77-86) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report describes the results of a program to develop ion implantation/pulsed energy processing for spacecraft solar cell applications. The approach involves employing pulsed electron beam technology to achieve processing parameters not previously possible by conventional furnace heat treatments. Optimization of the ion implanted solar cell structure was undertaken but not completed. Cells with efficiencies to 13.7% AMO were achieved using furnace annealing and to 12.9% AMO using pulsed electron beam annealing. Prospects for future development to higher efficiencies and for totally automated production are excellent. Experimental evidence suggests that the ion implanted, pulsed electron beam annealed solar cell may have better inherent tolerance to electron irradiation than similar diffused or furnace annealed implanted junction cells. Author (GRA)

N79-19467# National Bureau of Standards, Washington, D. C. Center for Building Technology.

GEOGRAPHICAL VARIATION IN THE HEATING AND COOLING REQUIREMENTS OF A TYPICAL SINGLE-FAMILY HOUSE, AND CORRELATION OF THESE REQUIREMENTS TO DEGREE DAYS

Edward A. Arens and William L. Carroll Nov. 1978 64 p refs Sponsored in part by HUD and Assistant Sec. for Policy Develop. and Res.

(Contract E(49-1)-3800)

(PB-289204/0; NBS-BSS-116) Avail: NTIS HC A04/MF A01 CSCL 10A

Test Reference Year (TRY) hourly climate data tapes are assessed to determine how well they represent long-term average climate when used for estimating average annual heating and cooling requirements. A method to adjust heating and cooling requirements is presented. The geographic variations of annual heating and cooling requirements across the U.S. are quantified by computing the heating and cooling requirements of a typical ranch-style residence for the 8760 hours of each of the 60 TRY tapes and the results are adjusted. The effectiveness of degree-day data for predicting these computed annual heating and cooling requirements is examined, and the variability of heating and cooling requirements within degree-day zones of 1000 degree-day width is presented. GRA

N79-19468# AIA Research Corp., Washington, D. C.

PHASE ONE/BASE DATA FOR THE DEVELOPMENT OF ENERGY PERFORMANCE STANDARD FOR NEW BUILDINGS. TASK REPORT: BUILDING CLASSIFICATION

12 Jan. 1978 131 p

(Contract HUD-H-2689)

(PB-286904/8; HUD-0000194) Avail: NTIS HC A07/MF A01 CSCL 13A

Building classifications to aid in the derivation of energy performance standards for the construction of new buildings are presented. An effort was made to develop a system of building classifications appropriate to the collection of data on designed energy performance and the implementation of national energy performance standards under Title III of the Energy Conservation and Production Act. Two classification schemes are described: a general classification system encompassing all building types using energy for space conditioning, and an abbreviated classification system for data collection that includes only building types expected to contribute significantly to construction volume over the next 10 years. GRA

N79-19469# Nuclear Regulatory Commission, Washington, D. C. Cost-Benefit Analysis Branch.

COAL AND NUCLEAR: A COMPARISON OF THE COST OF GENERATING BASELOAD ELECTRICITY BY REGION

Jack O. Roberts, Sarah M. Davis, and Darrel A. Nash Dec. 1978 113 p

(PB-289585/2; NUREG-0480) Avail: NTIS HC A06/MF A01 CSCL 10B

The results of an economic comparison by region of coal and nuclear fueled electric generating options that may be available to utilities during the late 1980's and early 1990's are reported. Some of the many factors that may be considered by public agencies and electric utilities in planning to meet future electric energy needs are discussed. The timeframe is for generating units now in the planning stages and units which are expected to enter the licensing phase over the next few years. These generating units would enter the operational phase in the late 1980's. GRA

N79-19470# Society of Petroleum Industry Biologists, Los Angeles, Calif.

ENERGY/ENVIRONMENT 1978: SYMPOSIUM ON ENERGY DEVELOPMENT IMPACTS

June Lindstedt-Siva Aug. 1978 340 p Symp. held at Los Angeles, Calif., 22-24 Aug. 1978

(PB-288578/8; LC-78-110283) Avail: NTIS HC A15/MF A01 CSCL 13B

The Proceedings volume contains 27 papers on subjects such as the management and use of biological and archaeolgical baseline data; ecological impacts of energy development (coal mines, offshore oil, power plants, pipelines); energy development and public policy; oil spills; fate and effects and minimizing the environmental impacts of oil spills. GRA

N79-19471# Society of Automotive Engineers, Inc., Warrendale, Pa.

BATTERY EXPLOSION TESTS AND LABELING Final Report, Jul. 1977 - May 1978

May 1978 99 p

(Contract DOT-HS-7-01662)

(PB-288745/3; DOT-HS-803665) Avail: NTIS HC A05/MF A01 CSCL 10C

Battery explosion test procedures and a criteria of pass-fail were developed for all lead-acid automobile batteries. A standard procedure for using battery booster cables to jump start engines was also developed. A battery booster cable standard is presented. A warning lebel for batteries was developed but is not recommended for use on automotive batteries. It was found that present labeling practices are adequate to warn users of the dangers associated with batteries. Based on extremely limited data it appears that injuries involving storage batteries occur but rarely. GRA

N79-19472# General Accounting Office, Washington, D. C. Energy and Minerals Div.

EVALUATION OF FOUR ENERGY CONSERVATION PROGRAMS--FISCAL YEAR 1977

21 Nov. 1978 90 p

(PB-288825/3; EMD-78-81) Avail: NTIS HC A05/MF A01 CSCL 10A

The report reviews four programs: Energy conservation and renewable-resource obligation guarantees, national energy conservation and renewable-resource demonstration for existing

dwelling units, supplemental State energy conservation plans, and weatherization assistance for low-income persons. GRA

N79-19016*# Spectrolab, Inc., Sylmar, Calif.
SOLAR PANEL ACCEPTANCE TESTING USING A PULSED SOLAR SIMULATOR
T. L. Hershey *In* NASA. Goodard Space Flight Center Ninth Conf. on Space Simulation 1977 p 27-45 (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 10A

N79-19030*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ESTIMATION OF OUTGASSING FROM AN EXPENDED APOGEE MOTOR AND ITS EFFECTS ON SPACECRAFT SURFACES
John J. Scialdone, John F. Rogers, and Raymond Kruger *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 221-241 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 10A

N79-19059*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE UPDATED ALGORITHM OF THE ENERGY CONSUMPTION PROGRAM (ECP): A COMPUTER MODEL SIMULATING HEATING AND COOLING ENERGY LOADS IN BUILDINGS
F. L. Lansing, D. M. Strain, V. W. Chai, and S. Higgins *In its* The Deep Space Network 15 Feb. 1979 p 107-115 (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 10B

N79-19060*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A TWO-DIMENSIONAL THERMAL ANALYSIS OF A NEW HIGH-PERFORMANCE TUBULAR SOLAR COLLECTOR
F. L. Lansing and C. S. Yung *In its* The Deep Space Network 15 Feb. 1979 p 116-131 refs (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-19473 Minnesota Univ., Minneapolis.
MATHEMATICAL ANALYSIS OF AIR POLLUTION MODELS Ph.D. Thesis
Christian Seigneur 1978 251 p
Avail: Univ. Microfilms Order No. 7906373

A method for linear sensitivity analysis of chemical systems governed by ordinary and partial differential equations is presented. It was based on the sensitivity of the solution of an optimization problem to variations in the model parameters. The sensitivity analysis was done with respect to an objective function, which was defined as a norm involving one or several dependent variables; and it gave the effect of impulse changes in the model parameters on the objective function. The method was compared with other methods of sensitivity analysis and it was implemented with a four step kinetic scheme. The sensitivity parameters corresponding to the effect on the system of changes in the velocities, diffusion and reaction rate coefficients, emission rates and initial conditions are presented. The method of sensitivity analysis was applied to a 124-step photochemical smog mechanism. Dissert. Abstr.

N79-19474 Committee on Environment and Public Works (U. S. Senate).
NOISE CONTROL ACT OVERSIGHT, PART 1
Washington GPO 1978 133 p refs Hearing before the Subcomm. on Resource Protection of the Comm. on Environment and Public Works, 95th Congr., 2d Sess., 18 Mar. 1978
(GPO-27-456) Avail: Subcomm. on Resource Protection

A record of the oversight hearing conducted by the Senate Resource Protection Subcommittee regarding the Noise Control Act of 1972 is presented. The hearing was called to evaluate the past performance of the noise control program and to provide guidance for future activities before new legislation is enacted. A national program called ECHO (Each Community Helps Others) was sighted to evaluate the effectiveness of the Government program. The testimonies of witnesses from various organizations are presented. G.Y.

N79-19475# National Technical Information Service, Springfield, Va.
NITROGEN OXIDE AIR POLLUTION. PART 4: BIOLOGICAL EFFECTS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1973 - Sep. 1978
Diane M. Cavagnaro Dec. 1978 137 p
(NTIS/PS-78/1337/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 04A

These 131 citations from worldwide literature cover the effects that nitrogen oxides have upon animals, humans, and plants. Most of the reports cover animal laboratory studies designed to determine the effects on the respiratory system. GRA

N79-19476*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PROCESS AIR QUALITY DATA Final Technical Report, Jan. 1977 - Mar. 1978
Charles M. Butler (Mississippi State Univ.) and John E. Hogge Mar. 1978 112 p refs
(Grant NsG-1375)
Avail: NTIS HC A06/MF A01 CSCL 13B

Air quality sampling was conducted. Data for air quality parameters, recorded on written forms, punched cards or magnetic tape, are available for 1972 through 1975. Computer software was developed to (1) calculate several daily statistical measures of location, (2) plot time histories of data or the calculated daily statistics, (3) calculate simple correlation coefficients, and (4) plot scatter diagrams. Computer software was developed for processing air quality data to include time series analysis and goodness of fit tests. Computer software was developed to (1) calculate a larger number of daily statistical measures of location, and a number of daily monthly and yearly measures of location, dispersion, skewness and kurtosis, (2) decompose the extended time series model and (3) perform some goodness of fit tests. The computer program is described, documented and illustrated by examples. Recommendations are made for continuation of the development of research on processing air quality data. M.M.M.

N79-19477*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Physics.
THE INVESTIGATION OF ADVANCED REMOTE SENSING TECHNIQUES FOR THE MEASUREMENT OF AEROSOL CHARACTERISTICS Final Report, Sep. 1975 - Dec. 1977
Adarsh Deepak and Jacob Becher Mar. 1979 68 p refs
(Grant NsG-1252)
(NASA-CR-158171; PTR-79-3) Avail: NTIS HC A04/MF A01 CSCL 13B

Advanced remote sensing techniques and inversion methods for the measurement of characteristics of aerosol and gaseous species in the atmosphere were investigated. Of particular interest were the physical and chemical properties of aerosols, such as their size distribution, number concentration, and complex refractive index, and the vertical distribution of these properties on a local as well as global scale. Remote sensing techniques for monitoring of tropospheric aerosols were developed as well as satellite monitoring of upper tropospheric and stratospheric aerosols. Computer programs were developed for solving multiple scattering and radiative transfer problems, as well as inversion/retrieval problems. A necessary aspect of these efforts was to develop models of aerosol properties. F.O.S.

N79-19478*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF INTERFERENTIAL CORRELATION OF SPECTRUM TO THE DETECTION OF ATMOSPHERIC POLLUTANTS
G. Fortunato Mar. 1979 25 p refs Transl. into ENGLISH from J. of Optics (Paris), v. 9, no. 5, 1978 p 281-290 Original language document was announced as A79-14479 Transl. by

Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75427) Avail: NTIS HC A02/MF A01 CSCL 13B

The general correlation principles for spectra and spectra derivatives are studied by using the Fourier transform of the spectral distribution of energy from a source illuminating a double beam interferometer with transverse splitting by dividing luminance. In this correlation technique, the use of such an interferometer has the advantage of greater luminosity as compared with a slit spectrometer. However, the correlation example indicates that it is necessary to adapt the correlator to the particular case considered, in order to obtain the best gain in the signal to noise ratio. In the case of sulfur dioxide detection, a very simple mounting which could be used in some interesting industrial applications was developed. This mounting can be used each time that the substance to be analyzed has a quasi-periodic absorption spectrum: in particular this is often the case with absorption spectra of gases, and a mounting identical to the one described for sulfur dioxide proved to be effective in the detection of nitrogen oxides. M.M.M.

N79-19479# Naval Ocean Systems Center, San Diego, Calif.
AUTOMATED ANODIC STRIPPING VOLTAMMETRY FOR THE ANALYSIS OF COPPER, ZINC, LEAD AND CADMIUM FOR ENVIRONMENTAL MONITORING Research and Development Report, Oct. 1975 - Apr. 1977
P. Kenis, A. Zirino, and C. Clavell Jun. 1978 23 p refs
(AD-A062004; NOSC/TR-243) Avail: NTIS HC A02/MF A01 CSCL 13/2

Automated anodic stripping voltammetry (AASV) is a tool for measuring, in the field, the concentrations of copper, zinc, lead and cadmium in marine waters. Measurements can be made within 10 to 15 minutes. Results obtained by AASV were compared to those obtained by atomic absorption spectrophotometry and were found to be the same within experimental error. Author (GRA)

N79-19480# PEDCo-Environmental, Inc, Cincinnati, Ohio.
ASSESSMENT OF FUGITIVE PARTICLE EMISSION FACTORS FOR INDUSTRIAL PROCESSES Final Report
John M. Zoller, J. Thomas Bertke, and Thomas A. Janszen Sep. 1978 194 p refs
(Contract EPA-68-02-2585)
(PB-288859/2; EPA-450/3-78-107) Avail: NTIS HC A09/MF A01 CSCL 13B

A priority listing of industrial processes emitting fugitive particulates and which are in need of source sampling is provided. Criteria for priority listing are total potential uncontrolled fugitive particulate emissions (industry-wide), and adequacy of currently available fugitive emission factor data. Each emission factor was evaluated for its adequacy for inclusion into AP-42. Adequacy of factors ranged from very poor (based on estimates, assumed values, or unknown development) to very good (based on complete test data). An appendix contains the fugitive particulate emission factors in a format suitable for input into AP-42. Also included in the appendix is particle size information. GRA

N79-19481# Pacific Environmental Services, Inc., Santa Monica, Calif.
SEASONAL VARIATIONS IN ORGANIC EMISSIONS FOR SIGNIFICANT SOURCES OF VOLATILE ORGANIC COMPOUNDS Final Report
Lowell G. Wayne and Clarence L. Boyd Jun. 1978 62 p
(Contract EPA-68-02-2583)
(PB-288867/5; EPA-450/3-78-023) Avail: NTIS HC A04/MF A01 CSCL 13B

Discrepancies between rates of emission of VOC determined on an annual basis and those occurring summer were studied, using as example areas Tampa Bay, St. Louis and Buffalo. Reactive VOC's were estimated by correcting total VOC's for methane content. A methodology for adapting VOC inventories to reflect summer emission patterns is outlined. The indicated increase in rate of emissions due to summer conditions ranged from 3 to 14 percent, as applied to the estimated annual non-methane emissions. The effect of temperature is the principal cause of increased VOC emissions in summer. At least 80 percent of VOC's came from gasoline-powered vehicles and from evaporation of solvents and petroleum products. Improved controls on evaporative emissions could change the relative importance of exhaust and evaporative effects. GRA

N79-19482# Compass Systems, Inc., San Diego, Calif.
USER GUIDE FOR THE ENHANCED HYDRODYNAMICAL-NUMERICAL MODEL Final Report, 1975 - 1977
A. D. Stroud and R. A. Bauer Aug. 1978 152 p
(Contract EPA-68-03-2225)
(PB-288464/1; EPA-600/3-78-074) Avail: NTIS HC A08/MF A01 CSCL 13B

The documentation required for use of the Enhanced Hydrodynamical-Numerical Model on operational problems is provided. The enhanced model is a multilayer Hansen type model extended to handle near-shore processes. The guide includes a description of the model system, source code maintenance procedures, notes on implementation, functional descriptions of routines and option sets, listings, and example runs for a test data set. GRA

N79-19483# Mason and Hanger-Silas Mason Co., Inc., Leonardo, N. J.
PERFORMANCE TESTS OF FOUR SELECTED OIL SPILL SKIMMERS Final Report
Robert W. Urban (Pollution Abatement Associates), Douglas J. Graham (Pollution Abatement Associates), and Sol H. Schwartz Sep. 1978 84 p refs
(Contract EPA-68-03-0490)
(PB-288549/9; EPA-600/2-78-204) Avail: NTIS HC A05/MF A01 CSCL 13B

Oil spill pickup devices (skimmers) were tested for two weeks with both high and low viscosity oils. The objectives of the tests were to establish the range of best performance for each skimmer under the manufacturer's design limits and to document test results on 16mm film and by quantitative measures of performance. The four oil skimmers studied by the OHMSETT Interagency Test Committee were: (1) oil mop skimmer - a catamaran vessel designed primarily for oil skimming at speeds above 1.5 m/s. (2) cyclonet 050 - a device mounted on an inflatable boat designed for oil skimming in relatively calm water. (3) clowsor skimmer - a unit designed primarily for recovering oil at very high rates while held stationary in calm water. (4) Bennett Mark 6E - a semi-catamaran vessel designed for skimming oil at speeds up to 1.5 m/s. A total of 198 individual data test runs were made. GRA

N79-19484# Research Triangle Inst., Research Triangle Park, N. C.
ANALYSIS OF CASCADE IMPACTOR DATA FOR CALCULATING PARTICLE PENETRATION Final Report, Jun. - Aug. 1978
Phil A. Lawless Sep. 1978 47 p refs
(Contract EPA-68-02-2612)
(PB-288649/7; EPA-600/7-78-189) Avail: NTIS HC A03/MF A01 CSCL 13B

The difficulties of analyzing cascade impactor data to obtain particle penetrations according to size are discussed. Several methods of analysis (interpolation, least-squares fitting, and spline fitting) are considered and their merits are weighed. The use of transforming functions prior to data fitting are also discussed. The use of the normal transformation and spline fitting method are recommended, and computer programs are provided to facilitate its use. GRA

N79-19485# Connecticut Univ., Storrs. Inst. of Water Resources.
CHARACTERISTICS OF INCINERATOR RESIDUE AND THE EFFECT OF ITS LEACHATE ON GROUNDWATER QUALITY
K. A. Healy, H. E. Klei, and D. W. Sundstrom Sep. 1978 17 p
(Contract DI-14-31-0001-6007)
(PB-288641/4; W79-01090; OWRT-A-067-CONN(2)) Avail: NTIS HC A02/MF A01 CSCL 13B

A project designed to determine the hydraulic and mechanical characteristics of incinerator residue from solid wastes and from sewage sludges is summarized. The hydraulic permeability and strength of compacted incinerator residue were measured. Qualitative and quantitative leaching characteristics of un-

quenched municipal sewage sludge incinerator ash were studied with respect to amount of water applied and pH variation. Chemical digestion by wet decomposition of unquenched ash showed high residual concentrations of magnesium, sodium, calcium and potassium. Iron was contained in the highest residual concentration of all heavy metals monitored, with zinc second and chromium, cobalt, copper, manganese, nickel and lead present in lower concentrations. GRA

N79-19486# GCA Corp., Bedford, Mass. GCA Technology Div.

EVALUATION OF MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE PROGRAMS IN WISCONSIN, PHASE 3 Final Report

Theodore P. Midurski, Lee A. Coda, Robert O. Phillips, Nancy Roy, and Frederick Sellars Nov. 1978 228 p refs

(Contract EPA-68-02-2607)

(PB-289117/4; GCA-TR-78-53-G; EPA-905/2-78-004) Avail: NTIS HC A11/MF A01 CSCL 13B

A firm schedule for implementing a motor vehicle inspection and maintenance(I/M) program in the highly urbanized nonattainment areas is developed. In this connection, the State of Wisconsin is currently planning for the implementation of an I/M program. Detailed analyses have been performed of the costs, benefits, personnel requirements, direct and indirect impacts, and scheduling requirements associated with the particular program option being considered. GRA

N79-19487# National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.

DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE NEW YORK BIGHT, FIRST AND SECOND MONITORING CRUISES, NOVEMBER 1975 AND MARCH 1976

Janice Caracciolo (National Marine Fisheries Svs, Highlcnd, N.J.), John Pearce (National Marine Fisheries Svs, Highland, N.J.), Martha Halsey (National Marine Fisheries Svs, Highland, N.J.), and Leslie Rogers (National Marine Fisheries Svs, Highland, N.J.) Sep. 1978 53 p refs

(PB-290145/2; NOAA-DR-ERL-MESA-40) Avail: NTIS HC A04/MF A01 CSCL 13B

Analyses of benthic communities were used since 1968 to indicate impacts from contaminants on the ecosystem of the New York Bight apex. This data report is a product of the fourth phase, monitoring of selected stations in the apex, and was prepared to provide machine listed data and certain statistical calculations, diversity and equitability concerned with the distribution and abundance of benthic organisms collected at 18 monitoring stations located in the standard New York Bight MESA sampling grid. Data from these stations will yield information on changes in the Bight over time by providing more replicate samples which may be compared with earlier samples collected at the same stations. GRA

N79-19488# Environmental Protection Agency, Ann Arbor, Mich. Technical Assessment and Evaluation Branch.

EFFECTS OF LOW AMBIENT TEMPERATURE ON THE EXHAUST EMISSIONS AND FUEL ECONOMY OF 84 AUTOMOBILES IN CHICAGO

Wayne Heinmiller Oct. 1978 25 p refs

(PB-288400/5) Avail: NTIS HC A02/MF A01 CSCL 13F

The results of a project are described in which pairs of tests were conducted in 84 in-use passenger cars, once under low temperature conditions (16 F to 57 F), and again under standard laboratory conditions. Each sequence included the 1975 Federal Test Procedure (exhaust emissions only), the Highway Fuel Economy Test and three short cycle tests. The vehicles were randomly obtained, tested in an as-received condition, and work was performed between January and March 1978. Results show that HC and CO are most sensitive to cold temperature, while NOX is affected only slightly. Fuel economy suffered by an average of 7% Vehicle fleets from manufacturers which used different control technologies were found to behave considerably differently at low temperatures. GRA

N79-19489# United States of America National Committee for the International Association on Water Pollution Research. Dept. of Civil Engineering.

DEVELOPMENTS AT 9TH INTERNATIONAL CONFERENCE ON WATER POLLUTION RESEARCH Technical Report, 3 Apr. - 31 Dec. 1978

Sep. 1978 239 p Conf. held at Stockholm, 12 - 16 Jun. 1978

(Grant EPA-R-805-756010)

(PB-288650/5; EPA-600/9-78-039) Avail: NTIS HC A11/MF A01 CSCL 13B

Information of particular significance concerning developments in international water pollution research included: in the developed countries the emphasis is changing from energy intensive physical-chemical processes back to biological systems for removal of both organic matter and nutrients from wastewaters; a chemical-biological system for the removal of both organic matter and nutrients from wastewaters requires a design using mechanistic principles and parameters which integrate both the chemical and biological processes rather than treating them separately. GRA

N79-19490# Texas Transportation Inst., College Station.

NON-USER IMPACTS OF DIFFERENT HIGHWAY DESIGNS AS MEASURED BY LAND USE AND LAND VALUE CHANGES Interim Report, Sep. 1976 - Aug. 1977

Jesse L. Buffington, Cary W. Herndon, and Michael E. Weiss Mar. 1978 176 p refs Sponsored by State Dept. of Highways and Public Trans.

(PB-288875/8; TTI-2-8-77-225-2; FHWA/TX-78-225-2) Avail: NTIS HC A09/MF A01 CSCL 13B

The types of highway impacts, highway impact assessment elements, techniques available to measure land use and land value impacts, and findings of previous studies which indicate the magnitude of land use and land value changes resulting from various types of highway improvement are reviewed. The land use and/or land value impact measurement techniques are of three major types: (1) land use - land value measurement models, (2) land use - traffic models, and (3) land use - urban development models. GRA

N79-19491# Research Triangle Inst., Research Triangle Park, N. C.

COMPUTER ASSISTED AREA SOURCE EMISSIONS (CAASE) GRIDDING PROCEDURE (REVISED). UNIVAC 1110/EXEC 8 VERSION USER'S MANUAL Final Report

Richard C. Haws, J. W. Dunn, III, and Richard E. Paddock Mar. 1978 483 p

(Contract EPA-68-02-2501)

(PB-288904/6; EPA-450/3-78-010) Avail: NTIS HC A21/MF A01 CSCL 13B

Atmospheric dispersion modeling programs such as the Climatological Dispersion Model (CMD), Air Quality Display Model (AQDM), and Implementation Planning Program (IPP) are among the most basic tools used for evaluation of air quality and State Implementation Plans (SIP's). Since emissions data comprise the most important input information for these models, any factor affecting the availability and completeness of the emissions data has a significant impact on the results of the modeling programs. Procedures for formatting emissions from point sources are defined. All method for allocating county-level data to grid squares selected on the basis of demographic features is provided and sized to give appropriate detail for input to air quality modeling programs. GRA

N79-19492# Texas Transportation Inst., College Station. Dept. of Chemical Engineering.

TRAPS 2 USER'S GUIDE: ANALYTICAL AND EXPERIMENTAL ASSESSMENT OF HIGHWAY IMPACT ON AIR QUALITY Research Report, Sep. 1974 - Feb. 1978

J. A. Bullin and J. C. Polasek 21 Mar. 1978 39 p refs Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin

(PB-288886/5; TTI-2-8-75-218-2; FHWA/TX-78-218-2) Avail: NTIS HC A03/MF A01 CSCL 13B

Data from essentially all previous experimental programs were used to develop and verify an improved roadway dispersion model. The development of the TRAPS series of models is given here, along with a computer program employing the latest, or TRAPS II, version. The program is written as a subroutine in order to

allow maximum compatability with a large variety of computers. A listing of the subroutine and of a sample main program designed to use it are included. The subroutine itself performs no input/output functions, rather all I/O is handled by the main program. All required input values are listed along with an explanation of each term. The output terms are likewise listed and explained. In addition, the error and warning codes returned by the program as a result of invalid input parameters are discussed. GRA

N79-19493# Systems Applications, Inc., San Rafael, Calif.
CARBON MONOXIDE NETWORK DESIGN METHODOLOGY: APPLICATION IN THE LAS VEGAS VALLEY Final Report
James L. McElroy, Joseph V. Behar, Leslie M. Dunn, Mei-Kao Liu, and Terry N. Jerskey Sep. 1978 109 p refs
(Contract EPA-68-03-2399)
(PB-289875/7; EPA-600/4-78-053) Avail: NTIS HC A06/MF A01 CSCL 13B

An objective methodology that uses aerometric data and an physically based air quality simulation model was proposed in a previous report for the optimal areas. The continuation of that work, the application of the proposed methodology to the urban Las Vegas area is described. The first part of this report contains an examination of the validity of the Atmospheric Pollution Simulation Model, a key component of the proposed methodology. It also describes an intensive field measurement program conducted to provide the necessary data base. The second part describes the selection of meteorological scenarios associated with high pollution potential in the Las Vegas Valley and presents the results of the application of the siting methodology. GRA

N79-19494# Texas Transportation Inst., College Station.
TRAPS 52 USER'S GUIDE: ANALYTICAL AND EXPERIMENTAL ASSESSMENT OF HIGHWAY IMPACT ON AIR QUALITY Interim Research Report
J. A. Bullin and J. C. Polasek 21 Mar. 1978 30 p refs Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin
(PB-289228/9; RR-218-3; FHWA/TX-78-218(3)) Avail: NTIS HC A03/MF A01 CSCL 04A

TRAPS 52 is a simplified version of the TRAPS 2 air pollution dispersion model. This version was designed to run on the SR52 hand held programmable calculator. The program calculates the carbon monoxide concentration at any distance downwind from a roadway, given site geometry, meteorology, and traffic parameters. The program is quite flexible, accepting inputs in either metric units, English units, or a mixture of both. Many errors occur later, a code indicating the most probable cause is returned. Meteorology and traffic parameters can be updated without changing the site geometry for running multiple cases at a single site. GRA

N79-19495# Environmental Monitoring and Support Lab., Las Vegas, Nev.
DEVELOPMENT OF A POLLUTANT MONITORING SYSTEM FOR BIOSPHERE RESERVES Final Report
G. Bruce Wiersma, Kenneth W. Brown, and Alan B. Crockett Sep. 1978 124 p
(PB-288548/1; EPA-600/4-78-052) Avail: NTIS HC A06/MF A01 CSCL 06F

The report presents an initial approach to identifying and solving the problems of developing a monitoring system for Biosphere Reserves. Most proposals have only focused on the selection of Reserves, pollutants to monitor, etc.; the real-world problems of how to monitor and collect and preserve samples and of statistical considerations and the logistics involved, have not been considered. The report attempts to address these problems and proposes specific field work to determine what additional problems may be encountered and what research is still required to enable us to develop a responsive and cost-effective pollutant monitoring program for Biosphere Reserves. Items covered include sample site selection criteria, statistical considerations, pollutant level monitoring techniques suitable to background areas, the development of biological monitors and accumulators and the development and application of pollutant impact monitoring techniques. Quality assurance requirements are also discussed. The above subjects are set in a site-specific framework of Yellowstone National Park and Sequoia-Kings Canyon National Parks. GRA

N79-19496# Water Purification Associates, Cambridge, Mass.
WATER-RELATED ENVIRONMENTAL EFFECTS IN FUEL CONVERSION. VOLUME 2: APPENDICES Final Report, Oct. 1976 - Sep. 1978
David J. Goldstein Oct. 1978 666 p refs
(Contract EPA-68-03-2207)
(PB-288874/1; EPA-600/7-78-197B-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 07A

Results of an examination of water-related effects that can be expected from siting conversion plants in the major U.S. coal and oil shale bearing regions are reported. Ninety plant-site combinations were studied: 48 in the Central and Eastern U.S. and 42 in the Western. Synthetic fuel technologies examined include: coal gasification to convert coal to pipeline gas; coal liquefaction to convert coal to low sulfur fuel oil; coal refining to produce a de-ashed, low-sulfur solvent refined (clean) coal; and oil shale retorting to produce synthetic crude. The range of water requirements, conditions for harrowing the range and optimizing the use of water, ranges of residual solid wastes, and cost and energy requirements for wastewater treatment are presented. GRA

N79-19497# Rhode Island Univ., Kingston. Dept. of Animal Pathology.
OZONATION FOR CONTROL OF ENTERIC VIRUSES IN SEWAGE EFFLUENT Final Report, 1 Oct. 1976 - 30 Sep. 1978
Pei Wen Chang Oct. 1978 13 p
(Contract DI-14-34-0001-8042)
(PB-288688/5; W79-01088; OWRT-A-064-Ri(1)) Avail: NTIS HC A02/MF A01 CSCL 06F

Guidelines for determining dosage and contact time of ozone with respect to virus inactivation in various types of secondary sewage effluent were attempted. It was found that the demand of ozone for the inactivation of 5 human enteric viruses, namely poliovirus type 1, 2 and 3; coxsackie virus type B5 and echovirus type 12 in secondary effluent from different sewage plants varied greatly. Variation also occurred during different seasons of the year within the same sewage plant. Because of these variations between and within sewage plants, a standard recommendation of ozone dosage and contact time cannot be applied for all plants or at all times within the same plants. GRA

N79-19498# Connecticut Univ., Storrs. Inst. of Water Resources.
A BIOASSAY TECHNIQUE TO EVALUATE THE EFFECT OF SECONDARY EFFLUENT ON ALGAL INTERACTIONS IN THE CONNECTICUT RIVER Final Report
F. R. Trainor and L. G. Harter Sep. 1978 13 p refs
(Contract DI-14-31-0001-8007)
(PB-288642/2; W79-01089; OWRT-A-075-CONN(1)) Avail: NTIS HC A02/MF A01 CSCL 06F

A bialgal assay was developed which can be used in municipal or industrial laboratories to measure the carrying capacity of the Connecticut River. The selection of the green alga, Golenkinia sp., and the diatom, Cyclotella meneghiniana, enables the assay to be practicable throughout the year. Initial cell numbers in the inocula are critical concerning the outcome of algal interactions. The effect of secondary effluent in small amounts stimulates the green algal population. The increased amount of secondary effluent permits a proliferation of diatom species in conjunction with a slower rate of algal succession. A trialgal assay employing the blue-green alga, Oscillatoria sp. can work during summer pollution seasons. Oscillatoria sp. can operate in a laboratory assay comparable to nature during late summer - early fall periods. GRA

N79-19499# National Technical Information Service, Springfield, Va.
NITROGEN OXIDE AIR POLLUTION. PART 1: CONTROL TECHNOLOGY. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1977 - Sep. 1978
Diane M. Cavagnaro Dec. 1978 228 p
(NTIS/PS-78/1334/8) Avail: NTIS HC $28.00/MF $28.00

CSCL 06T

These citations pertain to air pollution control of nitrogen oxides from both stationary and mobile sources. Engine design, boiler combustion modification, fluidized bed combustion, and the use and design of other pollution control equipment is covered. GRA

N79-19500# National Technical Information Service, Springfield, Va.

NITROGEN OXIDE AIR POLLUTION. PART 2: DETECTION AND ANALYSIS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1975 - Sep. 1978

Diane M. Cavagnaro Dec. 1978 173 p

(NTIS/PS-78/1335/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Detection and analysis of nitrogen oxides are discussed in this bibliography. The 167 citations cite the techniques and equipment used for gas analysis of exhaust emissions and flue gases. GRA

N79-19501# Federal Colstrip Transmission Corridor Study Project Team, Portland, Oreg.

DEVELOPING NUMERICAL VALUES TO ESTIMATE POTENTIAL ENVIRONMENTAL IMPACTS OF POWER TRANSMISSION CORRIDORS Final Report

Elmer H. Wirtz, John B. Pyrch, Mary A. Arneson, John W. Baglien, R. Gregg Berry, John C. Fisher, Gary O. Hathaway, Earl O. Skogley, and David J. Wester Nov. 1978 100 p refs Sponsored by Forest Serv.

(PB-288635/6) Avail: NTIS HC A05/MF A01 CSCL 13A

A procedure was developed for evaluating potential environmental impacts of alterntive electric transmission corridors for the Federal Colstrip Transmission Study Project. This procedure is employed to convert mapped environmental information from a wide variety of resources into number values (impact scores). These values allow direct comparisons of estimated impacts on those resources from the introduction of electric transmission facilities within alternative corridors. Both an estimate of the seriousness of the potential impact for each resource, as well as the relative importance of one resource as compared to another is incorporated. Additional features of this procedure include: its simplicity, adaptability, flexibility, and retention of resource identity. This procedure can be used to evaluate potential environmental impacts for other corridor-related projects. GRA

N79-19502# National Technical Information Service, Springfield, Va.

NITROGEN OXIDE AIR POLLUTION. PART 3: ATMOSPHERIC CHEMISTRY. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1976 - Sep. 1978

Diane M. Cavagnaro Dec. 1978 160 p

(NTIS/PS-78/1336/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

This bibliography contains 154 citations on the atmospheric chemistry of nitrogen oxides. They cover photochemical air pollution models, smog chemistry and reactivity, pollutants interaction with the atmosphere, the chemical reactions, and the rate of the reactions. GRA

N79-19023*# Vitro Labs., Silver Spring, Md.

NOISE IMPACT ON WILDLIFE: AN ENVIRONMENTAL IMPACT ASSESSMENT

Avi Bender *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 155-165 refs (For primary document see N79-19013 10-12)

Avail: NTIS HC A20/MF A01 CSCL 13B

N79-19032*# Ernest F. Fullam, Inc., Schenectady, N.Y.

AIRBORNE PARTICLE MONITORING BY ELECTROSTATIC PRECIPITATION

J. C. Robinson and I. T. Stoneback *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 267-275 refs (For primary document see N79-19013 10-12)

Avail: NTIS HC A20/MF A01 CSCL 13B

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N79-19503 Arizona State Univ., Tempe.

FLUORIDE-HYDROXYL EXCHANGE EQUILIBRIA IN SEVERAL HYDROUS MINERALS Ph.D. Thesis

Henry R. Westrich 1978 163 p

Avail: Univ. Microfilms Order No. 7906100

The thermochemical properties of several hydrous minerals were determined using a combination of dehydration equilibria, high temperature solution calorimetry, and fluoride-hydroxyl exchange experiments. The F-OH exchange experiments were conducted at temperatures ranging from 1173 to 1373 K at a fluid pressure of 4 kilobars, and included the measurement of fluorine partitioning between a hydrous mineral and an aqueous fluid and also between two coexisting minerals. The results of the crystal-fluid F-OH exchange equilibria were used to calculate activity coefficients for HF in H2O-HF fluid mixtures. The crystal-fluid exchange data were found to be consistent with the results of the F-OH mineral pair exchange data. Comparison of the results of the dehydration and calorimetry experiments suggests that previous thermodynamic data for several fluor-hydroxy minerals may be incorrect. Dissert. Abstr.

N79-19504 Brown Univ., Providence, R. I.

PETROGRAPHIC, STABLE ISOTOPIC, AND ELECTRON MICROPROBE STUDIES OF DIAGENESIS IN LIMESTONES Ph.D. Thesis

John Ridgway Allan 1978 257 p

Avail: Univ. Microfilms Order No. 7906513

An attempt was made to relate patterns of minor element and carbon and oxygen isotopic composition in whole-rock limestone samples and calcite cements to the diagenetic processes which produced them. The results are presented in four parts. In Part 1 carbon and oxygen isotopic patterns characteristic of vadose and freshwater phreatic diagenesis were identified in Pleistocene reef limestones of Barbados, West Indies. In Part 2, it was shown that these same patterns were preserved in several ancient limestone formations that had been exposed to near surface diagenetic processes. In Part 3, petrographic, stable isotope, and electron microprobe data were used to help unravel the multistage diagenetic history of the James Limestone, subsurface Cretaceous of East Texas. In Part 4, the carbon isotope pattern associated with nearsurface vadose diagenesis was used to identify a buried subaerial exposure on Barbados, West Indies. Dissert. Abstr.

N79-19505 California Univ., Los Angeles.

SOIL RADON MONITORING FOR EARTHQUAKE RESEARCH: A STUDY OF RADON CONCENTRATIONS USING ALPHA PARTICLE SENSITIVE FILMS IN SHALLOW SOIL HOLES ALONG THE SAN JACINTO FAULT ZONE IN SOUTHERN CALIFORNIA Ph.D. Thesis

George Franklin Birchard 1978 115 p

Avail: Univ. Microfilms Order No. 7906155

The detector integrates the concentration observed over the exposure period with a length generally from days to weeks and short period noise is removed. The method is very simple, is well suited to volunteer participation and is potentially very inexpensive. Three years of measurement show that radon concentrations in soil gas are high in the winter and low in the summer. Changes in soil moisture content are one cause of this annual cycle. Before earthquakes, radon concentration changes have been observed. Radon concentration increased three weeks before a M4.3 earthquake on the San Jacinto Fault in Southern California and the amount of increase was a function of the distance of the measurement site from the epicenter. Soil gas flow may be a sensitive function of changes in compression or dilation of the soil and underlying rock. Radon measurements may be monitoring very small changes in the strain field which occur prior to earthquakes. Dissert. Abstr.

N79-19506 California Univ., Berkeley.
SEISMOLOGICAL INVESTIGATIONS IN GEOTHERMAL REGIONS Ph.D. Thesis
Ernest Luther Majer 1978 232 p
Avail: Univ. Microfilms Order No. 7904540

Seismological methods, including studies of microearthquakes, P- and S-wave velocities and P-wave attenuation were investigated as tools for the exploration and delineation of geothermal resources. Seismograms from explosions and microearthquakes were examined for changes in frequency content and relative arrival times across a known geothermal area, The Geysers, California and a potential geothermal region, Grass Valley, Nevada. Microearthquakes within the two regions were examined for evidence of spatial variations in radiated P- and S-waves. Additional information concerning basin and range structure was provided by regional refraction studies. Detailed structural analysis in Grass Valley was obtained by commercial reflection and refraction work. Heat flow modeling, consistent with structure inferred by seismological techniques, was used to discriminate between conductive and convective heat flow anomalies in Grass Valley. Dissert. Abstr.

N79-19507 California Univ., Davis.
NITROGEN IN SEDIMENTARY MATERIALS Ph.D. Thesis
Anastasios Emmanuel Nychas 1978 82 p
Avail: Univ. Microfilms Order No. 7905202

Various nitrogen fractions, their isotopic composition and carbon/nitrogen ratios in sedimentary materials up to 1,700 MY old were studied. A great variability was found in these quantities not only with place and time of deposition, but even within deposits of the same profile. Differences in environmental conditions during formation of the sediments, as well as the type of depositional basin, contributed to this variability. For Phanerozoic time, changes in organic matter content of sedimentary rocks correlate with changes in land flora induced by global climatic modifications, which in turn correlate with variations of Epeiric sea area resulting from plate motion and plate interactions. Isotopic composition of various nitrogen fractions is not determined solely by environmental conditions during formation of sediments. Dissert. Abstr.

N79-19508 Purdue Univ., Lafayette, Ind.
ACID-BASE EQUILIBRIA IN CLAY SUSPENSIONS Ph.D. Thesis
Joseph Raymond Feldkamp 1978 94 p
Avail: Univ. Microfilms Order No. 7905716

The thermodynamics governing the equilibria of weakly basic compounds in dilute clay suspensions was developed. Use was made of relevant thermodynamic quantities to illustrate the sensitivity of the acid-base equilibrium to the interactions between the constituents participating in the equilibrium and colloidal surfaces. Consequently, addition of clay to an equilibrium mixture consisting of the neutral and protonated base, and hydrogen ions, can result in displacement of the reaction to a new point of stable equilibrium. The composition of the final mixture will then be different from that of the original mixture. This is equivalent to the principle of Le Chatelier. The above thermodynamic treatment was used to examine the frequently observed phenomenon that basic compounds in clay suspensions are often protonated to a much greater extent than that predicted on the basis of the pH of the bulk solution phase and the pK of the compound. Dissert. Abstr.

N79-19509 Stanford Univ., Calif.
FOUNDATIONS OF GRAVITATION THEORY: THE PRINCIPLE OF EQUIVALENCE Ph.D. Thesis
Mark Paul Haugan 1978 162 p
Avail: Univ. Microfilms Order No. 7905872

A new framework is presented within which to discuss the principle of equivalence and its experimental tests. The framework incorporates a special structure imposed on the equivalence principle by the principle of energy conservation. This structure included relations among the conceptual components of the equivalence principle as well as quantitative relations among the outcomes of its experimental tests. One of the most striking new results obtained through use of this framework has a connection between the breakdown of local Lorentz invariance and the breakdown of the principle that all bodies fall with the same acceleration in a gravitational field. An extensive discussion of experimental tests of the equivalence principle and their significance is also presented. Within the above framework, theory-independent analyses of a broad range of equivalence principle tests are possible. Dissert. Abstr.

N79-19510 Johns Hopkins Univ., Baltimore, Md.
INTERNAL GRAVITY WAVE GENERATION BY RESONANTLY INTERACTING SURFACE WAVES Ph.D. Thesis
Charlie Lee Yates 1978 204 p
Avail: Univ. Microfilms Order No. 7906502

Internal wave generation by way of the nonlinear, resonant interaction among progressive surface gravity waves is a mechanism that can account for a portion of the energy that is found to reside in internal waves as they naturally occur in the ocean. This report describes an experimental investigation of the mechanism which was carried out in a laboratory tank, wherein a stratified medium was produced by use of two immiscible fluid layers. Wave amplitude developments, for the condition of two forced surface components, were determined by use of capacitance wave probes and gauges, whose outputs were processed with a spectrum analyzer. The measured growth of the internal wave, in particular, is compared to the theoretically predicted behavior for both resonant and off-resonance conditions and for different values of the surface wave frequencies and amplitudes and of the interfacial density rise. Dissert. Abstr.

N79-19511 California Univ., Los Angeles.
CHARACTERISTICS OF ACOUSTIC-GRAVITY WAVES IN A DIFFUSIVELY SEPARATED ATMOSPHERE Ph.D. Thesis
Anthony Dominic Delgenio 1978 228 p
Avail: Univ. Microfilms Order No. 7906165

The properties of acoustic-gravity waves in an atmosphere in diffusive equilibrium are examined using a two-fluid model which takes into account the collisional transfer of both momentum and energy between species. The results are compared with Atmospheric Explorer-C satellite mass spectrometer measurements of wavelike thermospheric density fluctuations in an attempt to determine the periods, wavelengths, propagation directions and sources of the observed waves. Plane wave solutions in an atmosphere with constant collision frequencies are obtained by finding the eigenvalues and eigenvectors of the matrix of coefficients of the resulting system of four first-order equations. Numerical solutions of the two-point boundary value problem in an atmosphere with vertically varying collision frequencies are also obtained, using a Runge-Kutta integration scheme and iterative refinement of initial guesses of wave amplitudes. Dissert. Abstr.

N79-19512 Stanford Univ., Calif.
BURST PRECIPITATION OF ENERGETIC ELECTRONS FROM THE MAGNETOSPHERE Ph.D. Thesis
Bruce Kenneth Dingle 1978 130 p
Avail: Univ. Microfilms Order No. 7905880

Two procedures were developed for calculating the intensity and energy spectrum of bursts of precipitating electrons. The first method applied when low amplitude wave energy was driving the precipitation and gave quick results using a desk calculator. The second routine extended the computations to large wave amplitudes. Although it required a minicomputer for reasonable turn-around time, this extended version was nevertheless about two orders of magnitude faster than many-particle simulation routines that might otherwise be used. Dissert. Abstr.

N79-19513 Minnesota Univ., Minneapolis.
LOCALIZED HEATING EFFECTS IN THE QUIET POLAR THERMOSPHERE Ph.D. Thesis
Jay Robert Knutson 1978 127 p
Avail: Univ. Microfilms Order No. 7906340

The theoretical models used so successfully to analyze substorm heating are, unfortunately, unsuitable for analysis of heating that is highly localized in time and space. Therefore, an improved approach to numerical modeling of the dynamic response was developed. This led to several model predictions that were unlike those of spectral models yet reasonable when compared to actual measurements. The data previously used to discern high latitude quiet heating were obtained at high (450 km) altitude where quite different inputs produced similar results. In addition,

that data was intimately tied to an empirical model. Therefore, a unique composition data set from the open source mass spectrometer on Atmosphere Explorer C was used to locate and identify heating regions at lower altitudes (150-300 km), both with and without model influence. Dissert. Abstr.

N79-19514 Utah Univ., Salt Lake City.
SEICHES IN THE GREAT SALT LAKE Ph.D. Thesis
Po Wang 1978 136 p
Avail: Univ. Microfilms Order No. 7905077

Two dimensional gravitational seiches in the Great Salt Lake were investigated by numerical analysis to determine the periods and the features of free oscillation in the basin. The configuration and bathymetry of the south basin were resolved into a 229 grid-point network. The calculations were based upon the inverse interation process which possesses a fast rate of convergence in eigenvalue computation. The periods for the first three modes were computed and compared to the results of the analysis by the use of channel approximation. Because the real lake has considerable variation in the lateral boundaries, the channel approximation can only be very crude. When frictional and rotational effects were included in the computations, the friction effect was shown to have a more significant influence on the seiches than did the rotational effect. Dissert. Abstr.

N79-19515 California Univ., San Diego.
METHODS OF SEISMIC TRAVEL TIME CALCULATION AND INVERSION AND OF SYNTHESIZING HIGH FREQUENCY SEISMOGRAMS Ph.D. Thesis
Jan Diederik Garmany 1978 110 p
Avail: Univ. Microfilms Order No. 7904136

Two classical seismological problems are addressed. The first is purely kinematic; the relationship between velocity structure and the properties of geometric rays in a stratified medium. The second problem deals with the high frequency response of a continuously varying medium. The results of this research indicate that a different approach is recommended. Dissert. Abstr.

N79-19516 Hawaii Univ., Honolulu.
A MASS SPECTROMETRIC INVESTIGATION OF THE VOLATILE CONTENT OF DEEP SUBMARINE BASALTS Ph.D. Thesis
Diana Gail Graham 1978 187 p
Avail: Univ. Microfilms Order No. 7903494

High temperature Knudsen-cell quadrupole mass spectrometry was used to identify and determine amounts of gases contained in deep submarine basalt glassy rims and glass-vapor inclusions found in associated phenocrysts. Samples analyzed were from three different geologic settings: ocean ridges; Kilauea East Rift Zone, Hawaii; and near Bouvet Island, South Atlantic Basin. Glass-vapor inclusions from ocean ridge and Hawaiian samples released CO2 and SO2 gas above 1020 C, but showed no H2O release. A maximum value of 0.002 wt-% water has been calculated for these inclusions, using the detection limit of the mass spectrometer. The corresponding glass surrounding the phenocrysts averages 0.20 wt-% water in the ocean ridge and 0.62 wt-% water in the Hawaiian samples. Dissert. Abstr.

N79-19517*# Hawaii Univ., Honolulu.
GEOCHEMICAL DATA SYNTHESIS AND ANALYSIS Final Technical Report, 1 Dec. 1977 - 31 Jan. 1979
John A. Philpotts 1979 6 p refs
(Grant NsG-5203)
(NASA-CR-158231) Avail: NTIS HC A02/MF A01 CSCL 08G

Data obtained at the Goddard Flight Center were collected for the purpose of completing analyses started at Goddard in order to maximize the scientific yield of the geochemistry program which was terminated in 1977. The major analytical task undertaken was to complete Gd analyses on a large number of samples already analyzed by mass spectrometry for other rare earth element abundances at Goddard. Gd values are important for pinning down the central part of the geochemically significant rare earth abundance pattern and are especially useful in the high precision definition of the utilitarian Eu anomaly. Isotope-dilution Gd abundances were obtained for 39 samples. The data are for 27 partition-coefficient samples, six Apollo 15 and 16 breccia samples, four terrestrial impactities, and associated rock standards. G.Y.

N79-19518*# Lamont-Doherty Geological Observatory, Palisades, N. Y.
THE EFFECTS OF CONFINING PRESSURE AND STRESS DIFFERENCE ON STATIC FATIGUE OF GRANITE
Robert L. Kranz [1979] 51 p refs Submitted for publication
(Grant NGR-33-008-146)
(NASA-CR-158236; Contrib-0000) Avail: NTIS HC A04/MF A01 CSCL 08G

Samples of Barre granite were creep tested at room temperature at confining pressures up to 2 kilobars. The time to fracture increased with decreasing stress difference at every pressure, but the rate of change of fracture time with respect to the stress difference increased with pressure. At 87% of the short-term fracture strength, the time to fracture increased from about 4 minutes at atmospheric pressure to longer than one day at 2 Kb of pressure. The inelastic volumetric strain at the onset of tertiary creep, delta, was constant within 25% at any particular pressure but increased with pressure in a manner analogous to the increase of strength with pressure. At the onset of tertiary creep, the number of cracks and their average length increased with pressure. The crack angle and crack length spectra were quite similar, however, at each pressure at the onset of tertiary creep. Author

N79-19519*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY RESULTS OF PASSIVE MICROWAVE SNOW EXPERIMENT DURING FEBRUARY AND MARCH 1978
A. T. C. Chang, J. C. Shiue, H. Boyne (NBS, Boulder, Colo.), D. Ellerbruch (NBS, Boulder, Colo.), G. Counas (NBS, Boulder, Colo.), R. Wittmann (NBS, Boulder, Colo.), and R. Jones (NBS, Boulder, Colo.) Mar. 1979 114 p refs
(NASA-TP-1408; Rept-7802-F22) Avail: NTIS HC A06/MF A01 CSCL 04A

The purpose of the experiment was to determine if remote microwave sensing of snowpack data could be used to predict runoff, thereby allowing more efficient management of the water supply. A four-frequency microwave radiometer system was attached to a truck-mounted aerial lift and was used to gather data on snowpacks at three different sites in the Colorado Rocky Mountains. Ground truth data measurements (density, temperature, grain size, hardness, and free-liquid water content) were taken at each site corresponding to each microwave scan. L.S.

N79-19520*# National Aeronautics and Space Administration, Washington, D. C.
THE MAGNETIC ANOMALY OF THE IVREAZONE
G. Albert Mar. 1979 22 p refs Transl. into ENGLISH from Z. Geophys. (West Germany), v. 40, 1974 p 283-301 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75425) Avail: NTIS HC A02/MF A01 CSCL 08N

A magnetic field survey was made in the Ivreazone in 1969/70. The results were: significant anomaly of the vertical intensity is found. It follows the basic mainpart of the Ivrea-Verbano zone and continues to the south. The width of the anomaly is about 10 km, the maximum measures about +800 gamma. The model interpretation shows that possibly the anomaly belongs to an amphibolitic body, which in connection with the Ivrea-body was found by deep seismic sounding. Therefore, the magnetic anomaly provides further evidence for the conception that the Ivrea-body has to be regarded as a chip of earthmantle material pushed upward by tectonic processes. L.P.

N79-19521*# National Aeronautics and Space Administration. Pasadena Office, Calif.
BOREHOLE GEOLOGICAL ASSESSMENT Patent Application
William Spuck, III, inventor (to NASA) (JPL) Filed 4 May 1978 19 p Sponsored by NASA
(NASA-Case-NPO-14231-1; US-Patent-Appl-SN-903019) Avail: NTIS HC A02/MF A01 CSCL 08G

A method and apparatus are provided for performing geological assessments of a formation located along a borehole,

which includes a boring tool that bores a pair of holes into the walls of the borehole and into the surrounding strata, and a pair of probes installed in the holes. One of the probes applies an input such as a current or pressured fluid, and the other probe senses a corresponding input which it receives from the strata. The boring tool can include a series of rigid bore segments that can be easily installed in a housing that lies in the borehole, and apparatus for connecting the bore segments in series while also advancing them into the strata surrounding the borehole, so that a straight hole can be bored in the strata. NASA

N79-19522# World Meteorological Organization, Geneva (Switzerland).
GEOPHYSICAL ASPECTS AND CONSEQUENCES OF CHANGES IN THE COMPOSITION OF THE STRATOSPHERE
1978 309 p refs Proc. of WMO Symp. held at Toronto, 26-30 Jun. 1978
(WMO-511; ISBN-92-63-10511-1) Avail: NTIS HC A14/MF A01; WMO, Geneva Sw. Fr. 30

The photochemical destruction of ozone in the stratosphere and its consequences on man and his activities are discussed. Topics cover stratospheric chemistry, the total ozone content and its trends, sources and sinks, satellite ozone measurements, and the modeling and prediction of effects due to possible ozone depletion. For individual titles, see N79-19523 through N79-19556.

N79-19523# Brussels Univ. (Belgium).
PHOTODISSOCIATION PROCESSES IN THE STRATOSPHERE AND MESOSPHERE
Marcel Nicolet *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 3-10 (For primary document see N79-19522 10-46)
Copyright. Avail: NTIS HC A14/MF A01

Two important aspects of the photodissociation problem are a correct determination of the solar flux in the mesosphere and stratosphere, and an exact knowledge of the absorption cross sections of the various constituents. Although the photodissociation of molecular oxygen which is the source of atomic oxygen in the stratosphere and mesosphere, is known to be an important parameter in the terrestrial ozone photochemistry, the photodissociation of all other minor constituents must be also considered in relation with the O2 absorption. The best way to study the photochemical action of the solar radiation is to subdivide the ultraviolet spectrum in to several ranges. Considering that the radiation of wavelengths less than 100 nm is absorbed by O2, N2 and O in the thermosphere, where it leads to the ionization of these constituents, it is necessary to determine the behavior of the spectrum only at wavelengths greater than 100 nm. In this spectral region, an easy way to analyse the photodissociation processes is to refer to the action of the two constituents, O2 and O3, which absorb the solar ultraviolet radiation. A.R.H.

N79-19524# Atomic Energy Research Establishment, Harwell (England). Environmental and Medical Sciences Div.
KINETICS OF HO2 RADICAL REACTIONS OF ATMOSPHERIC INTEREST
R. A. Cox *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 17-24 refs Sponsored by U.K. Dept. of the Environ. (For primary document see N79-19522 10-46)
Copyright. Avail: NTIS HC A14/MF A01

The reactions (HO2 + NO 2 + M = HO2NO2 + M) and (HO2 + HO2 = H2O2 + O2) were studied over the pressure range 30 torr to 760 torr using molecular modulation spectrometry and UV absorption. The HO2 was generated by the photolysis of Cl2 in the pressure of excess H2 and O2. In the absence of NO2, the major products in this system are HCl and H2O2 with NO2 present, peroxynitric acid, HO2NO2, is a major product. Significant thermal decomposition of HO2NO2 could be avoided by using a sub-ambient temperature, 283 K. The HO2 concentrations were monitored by detection of the modulated absorption at 220 nm, which resulted from periodic square-wave photolysis of the gas mixtures. Measurement of the phase relationship of the modulated signal with the photolysis lamps allowed determination of the chemical life-time of HO2, and the magnitude of the absorption gave the HO2 concentration. A model of the chemistry then enabled evaluation of the rate constants for the HO2 reactions involved. A.R.H.

N79-19525# Cambridge Univ. (England). Dept. of Physical Chemistry.
LABORATORY STUDIES OF THE REACTIONS OF HYDROPEROXY RADICALS (HO2) HAVING STRATOSPHERIC IMPORTANCE
J. P. Burrows, D. I. Cliff, G. W. Harris, B. A. Thrush, and J. P. T. Wilkinson *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 25-27 refs (For primary document see N79-19522 10-46)
Copyright. Avail: NTIS HC A14/MF A01

Laser magnetic resonance spectroscopy provides a sensitive and unequivocal method of detecting HO2 radicals in the gas phase at total pressures up to about 10 Torr (1,4). Magnetic fields of up to 20 kG were used to bring Zeeman components into resonances with the 118.6 micron line of the water vapor laser. Detection was carried out within the laser cavity with great sensitivity. In other experiments HO2 radicals were generated by a wide variety of means, most commonly by the reaction of F, O, H atoms or HO radicals with hydrogen peroxide or by a Tesla discharge through hydrogen peroxide in an argon carrier. A fast flow system 25 mm in diameter with fixed observation point and sliding reactant injectors was used with total pressures normally between 1 and 2 torr. Systems where the concentration of HO2 is determined under conditions close to a chemical steady-state were considered. A.R.H.

N79-19526*# National Bureau of Standards, Washinton, D. C.
DECOMPOSITION OF NITROUS OXIDE AND CHLOROMETHANES ABSORBED ON PARTICULATE MATTER
R. E. Rebbert and P. J. Ausloos *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 31-35 refs Sponsored in part by NASA and the Manufacturing Chemists Association (For primary document see N79-19522 10-46)
Avail: NTIS HC A14/MF A01 CSCL 04A

The effect of pressure on the heterogeneous thermal and pyrolytic decomposition of nitrous oxides adsorbed on sand was studied. Results indicate that N2O adsorbed on certain sand surfaces can be decomposed by photons which nitrous oxide cannot absorb in the gas phase. There is also a thermal heterogeneous decomposition of nitrous oxide which also produces nitrogen. The photolysis of CC14, CFC13, CF2C12 adsorbed on fused quartz and on different types of sand was also investigated. There was no thermal heterogeneous reaction with any of these chloromethanes. Apparently the larger bond energy of approximately 74 kcal for the C-C1 bond compared to approximately 40 kcal for the N-O bond in N2O makes the thermal reaction inoperative for the chloromethanes. A.R.H.

N79-19527# Federal Aviation Administration, Washington, D. C.
UNCERTAINTIES IN EVALUATED ATMOSPHERIC RATE CONSTANTS
William S. Smith, Jr. *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 37-46 refs (For primary document see N79-19522 10-46)
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During recent considerations of the reduction of ozone by fluorocarbons, a much greater emphasis placed on the uncertainty in model preductions the study of uncertainty is essentially a scientific problem which, in order to be consistent with the prediction itself, must be addressed within the framework of existing models. The changes which have taken place in the models used for the climatic impact assessment program study are discussed. Although a small change resulted from a modified vertical transport parameterization, the major revisions are due to the inclusion of a fuller description of chlorine reactions in the model and changes in the estimated best values of the rate constants for some other important reactions. A.R.H.

N79-19528# Atmospheric Environment Service, Downsview (Ontario).
STRATOSPHERIC CONSTITUENT MEASUREMENTS FROM

PROJECT STRATOPROBE

W. F. J. Evans, H. Fast, J. B. Kerr, C. T. McElroy, R. S. OBrien, D. I. Wardle, J. C. McConnell (York Univ.), and B. A. Ridley (York Univ.) *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 55-59 refs (For primary document see N79-19522 10-46)

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Ten balloon flights in the project Stratoprobe series were made to obtain simultaneous measurements of stratospheric constituents against which to test the photochemical and radiative schemes which are employed in stratospheric models to project depletions of the ozone layer due to anthropogenic activities. Although the earlier flights concentrated on measurements of the nitrogen chemistry, additional instrumentation to measure chlorine chemistry constituents were added to the payload complement. A.R.H.

N79-19529*# Denver Univ., Colo. Dept. of Physics.

MEASUREMENTS OF CONSTITUENTS OF INTEREST IN THE PHOTOCHEMISTRY OF THE OZONE LAYER USING INFRARED TECHNIQUES

D. G. Murcray, J. W. Williams, D. B. Barker, A. Goldman, C. Bradford, and G. Cook *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 61-68 refs Sponsored in part by NASA, NSF, DOT, and the Manufacturing Chemists Association (For primary document see N79-19522 10-46)

Avail: NTIS HC A14/MF A01 CSCL 04A

Infrared solar spectra and infrared atmospheric emission spectra were obtained from the ground, from aircraft and from balloons. The initial detection of most stratospheric molecules was achieved by the solar spectral technique because better resolution helps remove interference from other molecules. Because the sun is an intense source of radiation, the resolution which can be obtained with good signal-to-noise, is greater than with atmospheric emission spectroscopy. Data are generally taken using a method that enhances the number of molecules in the optical path i.e. at large solar zenith angles for solar spectra and at low elevation angles for atmospheric emission spectra. The search for molecules which are predicted to be present but which, the detection of a molecule known to be present from other measurement techniques but observed for the first time in infrared solar spectra, and some further data on the variability of HNO3 are discussed. A.R.H.

N79-19530# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Chemie.

CRYOGENIC SAMPLING MEASUREMENTS OF STRATOSPHERIC GASES

D. H. Ehhalt *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 71-78 refs (For primary document see N79-19522 10-46)

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Cryogenic sampling for the collection of stratospheric air samples employs a cryogen, usually liquid Ne or liquid N2 to freeze out whole air samples, or in selective sampling, a subgroup of trace gases. The large sample size allows aliquotting and the simultaneous measurement of many trace gases. It further minimizes contamination or reaction of the sample with the container walls. Cryogenic whole air sampling is accomplished using a balloon-borne cryogenic sampler which consists of an array of 8 or 16 stainless steel cylinders, immersed in liquid neon. Each cylinder is connected to a common inlet manifold by a bellows-sealed stainless steel high vacuum valve which is driven by a motor. Besides cryogenic collection of whole air samples which allows the measurement of more stable molecules like H2, CH4, H2O, N2O, CO, CFCl3, CF2Cl2, selective cryogenic sampling techniques used which allow the enrichment and stabilization of rather reactive species, even radicals. The technique of matrix isolation is described and a few measurements of stratospheric HO2 and NO2 are presented. Data obtained by whole air sampling are discussed. A.R.H.

N79-19531# Oregon Graduate Center, Beaverton. Environmental Technology Dept.

STATUS REPORT ON GLOBAL CFM MEASUREMENTS

R. A. Rasmussen *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 81-82 (For primary document see N79-19522 10-46)

Copyright. Avail: NTIS HC A14/MF A01

Accurate measurements of the atmospheric concentrations of F-11 and F-12 are required to assess the tropospheric lifetimes of these species. A comparison of these data with their known release rates and the use of an appropriate global tropospheric budgetary model is inherent in the study approach. Because of the predominant northern hemispheric source, the variations in the concentration between the hemispheres requires a global measurement program. The first year of a coordinated global measurement program was launched using a minimum of four stations, two in the northern and two in the southern hemisphere, each measuring daily concentrations for a period of several years. Extensive calibrations and intercalibration of the instruments will be performed to ensure that the data from all locations will be internally consistent. It is anticipated that intercalibrations will be extended to other groups measuring the fluorocarbons and related species and to an absolute standard when one becomes available. A.R.H.

N79-19532# Atmospheric Environment Service, Downsview (Ontario).

THE DETECTION OF OH AND C10 IN UV SPECTRA OF THE SKY AND SUN MEASURED BY A BALLOON-BORNE HIGH RESOLUTION SPECTROMETER

C. T. McElroy and D. I. Wardle *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 85-89 refs (For primary document see N79-19522 10-46)

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A balloon-borne 60 cm f/6 plane grating Ebert type spectrometer with a resolution of 0.60A and having a small telescope and a programmable polarizer was used to measure stratospheric and mesospheric OH. The basic data from which the OH measurements are derived, comprise multiple coadded spectral scans from 3065A to 3100A of the sky radiation at 90 deg from the sun and 4 deg above the horizontal. The strong and weak components of the sky spectra demonstrate there is very little multiple scattering at km. The mean intensity of the weak spectrum (electric vector in the scattering plane) is about 4 percent of the strong spectrum but does contain a large proportion of continuum in addition to a structured component which is related to the strong spectrum or to the direct solar spectrum. The form of the weak spectrum manifests the anisotropy of the polarizability ellipsoid of oxygen and nitrogen molecules. The molecule anisotropy causes scattering of a depolarizing radiation at the same frequency as the incident light and also causes rotational Raman scattering. A method of estimating the strength of OH emission is given. A.R.H.

N79-19533*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RAPID SPACE/TIME VARIATIONS IN MESOSPHERIC OZONE

David Buhl, Larry W. Brown, and Frank J. Lovas (NBS, Washington) *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 95-97 refs (For primary document see N79-19522 10-46)

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A 5 meter telescope was used to observe variations in the narrow emission line which is present in the nightime emission spectrum of ozone. The line was measured for several nights on two different transitions of the ozone molecule at 110.8 GHz and 142.2 GHz. Individual spectra with a time resolution of 5 minutes were taken. The narrow emission line showed considerable variation in intensity indicating that the ozone layer from which its arises has a rather detailed structure. Analysis of the line profile shows that the emission is coming from an ozone layer in the 55-75 km region of the mesosphere. This layer has a column density of 2 x 10 to the 16th power molecules/sq cm in a vertical path through the region. Author

N79-19534*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STRATOSPHERIC OZONE MEASUREMENT WITH AN INFRARED HETERODYNE SPECTROMETER

Mian M. Abbas, Theodor Kostiuk, Michael J. Mumma, David Buhl, Virgil G. Kunde, Larry W. Brown, and David Spears (Lincoln

Lab.) *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 99-101 refs (For primary document see N79-19522 10-46)
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A stratospheric ozone absorption line in the 10 micron band was measured and resolved completely, using an infrared heterodyne spectrometer with a spectral resolution of 5 MHz. The vertical concentration profile of stratospheric ozone was obtained through an analytical inversion of the measured spectra line profile. The absolute total column density was 0.32 plus or minus 0.02 cm-atm with a peak mixing ratio occurring at approximately 24 km. The (7,1,6) - (7,1,7) O3 line center frequency was found to be 1043.1772 plus or minus 0.00033 cm/1 or 420 plus or minus 10 MHz higher than the P(24) CO2 laser line frequency. Author

N79-19535# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
RECENT TRENDS IN TOTAL OZONE AND OZONE IN THE 32-46 km LAYER
J. K. Angell and J. Korshover *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 107-114 refs (For primary document see N79-19522 10-46)
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In view of the continuing interest in possible anthropogenic influences on the ozone layer (chiefly through release of fluorocarbons), total-ozone data were updated to the autumn of 1976. In addition, because of the evidence from photochemical models that the percentage decrease in ozone due to fluorocarbon release should be considerably larger near the 40 km level than for the ozone column as a whole, the time variation in ozone amount in the 32-46 km layer (using the Umkehr method) is also presented. The mean-monthly values of total ozone reported in 'Ozone Data for the World' were averaged by season for each station, and the seasonal mean over the period of record evaluated. To eliminate the large annual oscillation in total ozone, the percentage deviation from each seasonal mean was determined yearly and the seasonal deviations placed back in calendar order. The station values were averaged by region, and a regional standard deviation determined based on individual station values. A.R.H.

N79-19536# Instituto Nacional de Meteorologia e Geofisica, Lisbon (Portugal).
TEN YEARS OBSERVATIONS OF TOTAL AND LAYERED OZONE OVER LISBON AND THEIR TRENDS
M. F. Figueira *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 115-119 refs (For primary document see N79-19522 10-46)
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Data from observations of total and layered ozone, the latter from the Umkehr effect, observed in Lisbon using the Dobson ozone spectrophotometer and a series of Mast Mod. 730-5 ozonesondes are analyzed for local trends. The relations between the ozone time and space perturbations and the observed state of motion of the atmosphere above are described. The problem of the anthropogenic influences in the field of atmospheric ozone behavior, which would have significant impact on earth's life is addressed. A.R.H.

N79-19537# National Oceanic and Atmospheric Administration, Boulder, Colo.
USE OF THE DOBSON SPECTROPHOTOMETER IN A VARIABLE WAVELENGTH MODE AS AN ALTERNATIVE TO THE UMKEHR MEASUREMENT FOR OBSERVING TRENDS IN THE VERTICAL DISTRIBUTION OF OZONE
John J. DeLuisi *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 125-130 refs (For primary document see N79-19522 10-46)
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Vertical ozone distribution information contained in the Umkehr measurement is derived from the scanning effect of the effective scattering layer (a layer in the atmosphere from which most of the scattered radiation arises) moving up through the atmosphere as the solar zenith angle increases. The altitude at which the effective scattering layers exists depends upon the strengths of molecular scattering and ozone absorption (i.e., wavelength) and the solar zenith angle. For fixed wavelengths, the change in sun-angle produces the scanning effect. Alternatively, a scanning effect can be produced by varying the wavelength at some fixed solar zenith angle such as the multiple-wavelength technique, a principle used in the Nimbus-4 backscattering ultraviolet satellite experiment. Greater flexibility for special applications can be had if both sun angle and wavelength are allowed to vary. It is shown that the ozone distribution information contained in the variable solar zenith angle (Umkehr) method is indifferent to the technique, within certain bounds dictated by the opacity of the atmosphere combined with limitations in instrumental sensitivity. A.R.H.

N79-19538*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
VARIATIONS IN THE UPPER STRATOSPHERE'S OZONE PROFILE
D. E. Robbins and J. G. Carnes (Lockheed Electron. Co., Houston, Tex.) *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 131-136 refs (For primary document see N79-19522 10-46)
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The ozone concentration profile was measured on five balloon flights using an instrument which employs the strong absorption in ultraviolet to measure ozone in situ. Altitudes up to 44 km were obtained. All the flights were made during the daytime except for one that was launched at 3 AM local time to obtain a nighttime profile and to observe sunrise effects. Although the measurements were obtained at different times of day and during different seasons, ozone concentrations in the upper stratosphere varied by only a few percent. Quadratic, least squares fits to the data between 34 km and 40 km for the four daytime flights, yield a mean concentration at 37 km of 1.02 x 10 to the 12th power molecules/cu cm with a 2 percent standard deviation. Measurements made through sunrise show a small increase in ozone at 37 km commencing shortly after the beginning of astronomical twilight. The concentration at 37 km returned to predawn levels about 2 1/2 hours later. A.R.H.

N79-19539# California Univ., Livermore. Lawrence Livermore Lab.
POSSIBLE VARIATIONS IN ATMOSPHERIC OZONE RELATED TO THE ELEVEN YEAR SOLAR CYCLE
Joyce E. Penner and Julius S. Chang *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 137-145 refs Sponsored in part by U.S. Dept. of Transportation Fed. Aviation Admin. (For primary document see N79-19522 10-46)
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Several plausible, mechanisms linking the hypothesized ozone variations with the solar cycle are reviewed and variation in solar UV flux is proposed as a possible mechanism. The effects of solar UV flux variability on the ozone record to date is examined with emphasis on measurements made at 40 km where both the variability, and chlorine increases due to past fluorocarbon releases should have their greatest effects. A time dependent model is used which includes a full set of chlorine chemistry reactions and can be operated in a mode which calculates temperature self-consistency. Results differ from those calculated with a model which does not consider chlorine chemistry. A.R.H.

N79-19540*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERIFICATION OF NIMBUS 4 BUV TOTAL OZONE DATA AND THE REQUIREMENTS FOR OPERATIONAL SATELLITE MONITORING
A. J. Miller (Natl. Weather Serv., Washington, D. C.), B. Korty (Natl. Weather Serv., Washington, D. C.), E. Hilsenrath, A. J. Fleig, and D. F. Heath *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 153-160 refs (For primary document see N79-19522 10-46)
Avail: NTIS HC A14/MF A01 CSCL 04A

Data obtained from the backscattering ultraviolet instrument on Nimbus 4 are compared with standardized observations such as ground based Dobson and M83 measurements. Results of the comparison are discussed and their impact on planning for a satellite ozone monitoring program is assessed. It is suggested

that the satellite data be used as a transfer standard whereby, if a discrepancy in an individual ground station is detected, that station instrument would be noted for recalibration. A.R.H.

N79-19541*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEASONAL VARIATION OF THE VERTICAL DISTRIBUTION OF STRATOSPHERIC OZONE AS OBSERVED WITH THE UMKEHR AND BUV METHODS
Carlton L. Mateer (Atmospheric Environ. Service, Can.), Donald F. Heath, and John J. DeLuisi (NOAA, Boulder, Colo.) *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 161-167 refs (For primary document see N79-19522 10-46)
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Month-to-month variations evidenced by ozone profiles inferred from the classical Umkehr observations and from the back-scattered ultraviolet (BUV) satellite observations made from the Nimbus 4 satellite are examined. Upper stratospheric ozone profiles derived from BUV and Umkehr data display similar seasonal variations of about the same phase and magnitude for the 38 km to 50 km region. Between 28 km and 38 km, the seasonal variations are less marked, but the same rough picture emerges for both data sets. If both data sets indicate an increasing (or decreasing) trend over a period of years, it is not possible to conclude that a trend exists unless separate means exists for monitoring stratospheric dust. Because of the stratosphere well above the Junge layer seems less likely to be affected by volcanic debris, BUV data should be superior to Umkehr data for monitoring trends in the 38 km to 50 km range, provided that the calibration problems of flying such a monitoring instrument in space can be overcome. A.R.H.

N79-19542# Windsor Univ. (Ontario). Dept. of Chemistry.
MEASUREMENT OF NITROUS OXIDE EVOLUTION RATES FROM AGRICULTURAL SOILS
D. J. McKenney and W. I. Findlay (Agr. Can. Res. Station, Harrow) *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 179-184 refs (For primary document see N79-19522 10-46)
(Contract NRC 032-1380/6897)
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A gas chromatograph equipped with a Ni-63 electron capture detector and a 10 ft by 1/8 inch porapak Q coukum column was used to measure rates of flux of nitrous oxide from soils under natural field conditions. Data collected from several agricultural situations indicates considerable fluctuation from site to site and from day to day. Moderately large flux rates, exhibited even by well aerated sandy soil, shows that N2O is released by bacterial nitrification as well as by bacterial denitrification in soils and this should be taken into account for global estimates. The possibility of a strong correlation between flux rate and fertilizer treatment is suggested. A.R.H.

N79-19543# Oslo Univ. (Norway). Inst. of Geophysics.
POSSIBLE INCREASE IN TOTAL OZONE DUE TO ANTHROPOGENIC RELEASE OF CARBON MONOXIDE AND NITROGEN OXIDES NEAR THE GROUND
Eigil Hesstvedt and Ivar S. A. Isaksen *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 185-189 refs (For primary document see N79-19522 10-46)
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The possibility of an increase in total ozone due to increased releases of nitrogen oxides and carbon monoxides is discussed. Calculations show that mixing ratios of the order of 0.1 ppb, as observed, are consistent with release rates of nitrogen oxides smaller than the present release from anthropogenic sources in the Northern Hemisphere. It is therefore, possible that a significant increase in ozone in the lower troposphere has occurred as a result of man's activities. This low-level increase in ozone contributes to the ozone column density to such a degree that it should not be ignored. Author

N79-19544*# National Aeronautics and Space Administration. Manned Spacecraft Center, Langley Station, Va.
ON THE COUPLED NATURE OF ATMOSPHERIC PHENOMENA
Linwood B. Callis *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 193-202 refs (For primary document see N79-19522 10-46)
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The interactions that take place in the stratosphere and the troposphere which are important to the maintenance of the chemical, dynamic, and thermal state and of the middle atmosphere, and which may be important in the determination of the state of the lower atmosphere are reviewed. Examples of these interactions due to either natural or anthropogenic processes are discussed, and promising areas for future research are indicated. Specific topics include: (1) coupling between temperature and chemistry via temperature dependent rate constants; (2) the effect of latitudinal temperature variations on zonal winds; (3) the effect of clouds, surface albedo, and the lower atmosphere on stratospheric chemistry due to the scattering and reflection of solar radiation; (4) the effect of trace constituents on thermal structure and thermal balance; (5) the effect of the stratosphere on tropospheric climate; (6) the effect of solar UV variability on stratospheric chemistry and temperature; and (7) the effect of trace constituents on stratospheric dynamics. A.R.H.

N79-19545# California Univ., Livermore. Lawrence Livermore Lab. Lawrence Livermore Lab.
THE EFFECTS OF A MASSIVE PULSE INJECTION OF NOx INTO THE STRATOSPHERE
W. H. Duewer, D. J. Wuebbles, and J. S. Chang *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 207-213 refs (For primary document see N79-19522 10-46)
(Contract W-7405-Eng-48)
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The response of a 1-D atmospheric model to very large NOx pulse injections comparable to those that might be produced in a nuclear exchange, was examined. Very large reductions in stratospheric ozone continued to be computed following a massive pulse injection of nitrogen oxide akin to that expected if several megatons of nuclear explosives in the mageton range were to be detonated, although smaller injections from devices of 250 kt or less yield would be expected to have a smaller effect on the total column of stratospheric ozone. A major limitation to the calculations made is that no attention was paid to interactions of changes in stratospheric chemistry with the atmospheric structure. The computed ozone depletions are weakly dependent on the transport parameters for the very large injection scenarios at the higher altitudes. A.R.H.

N79-19546*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SENSITIVITY OF A MODEL OF THE AMBIENT STRATOSPHERE TO EMPIRICAL INPUTS
Dixon M. Butler *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 221-227 refs (For primary document see N79-19522 10-46)
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The usefulness of a general application of sensitivity studies to the modeling of the ambient stratosphere using the GSFC steady-state photochemistry model is examined. The comparison of theoretical model results with field measurements of trace species is used to assess the applicability of the model to the stratosphere, to help determine the eddy diffusion profile, and to validate mechanisms within the photochemistry of the model. Specific examples of each are discussed and the results of a comprehensive sensitivity study used to elucidate certain points about the comparison are analyzed. A.R.H.

N79-19547*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERACTIONS OF SIMULTANEOUS PERTURBATIONS OF STRATOSPHERIC PHOTOCHEMISTRY
Dixon M. Butler and Richard S. Stolarski *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 229-232 refs (For primary document see N79-19522 10-46)
Avail: NTIS HC A14/MF A01 CSCL 04A

The combined effects of two specific ozone perturbation mechanisms are examined. The need to look back to predictions of the near past as well as the future as a means of testing

model results is emphasized. The two perturbations examined are that due to chlorofluoromethane (CFM) release and that due to the air pollutants CO and nitrogen oxide. A steady-state model is used to investigate the characteristics of the stratospheric-tropospheric photochemical system for differing levels of CO and nitrogen oxide fluxes at the ground and for simultaneously changing the stratospheric from CFM release. Two basic scenarios chosen to illustrate the competing effects of the two types of perturbation use the time-dependence for chlorine radical buildup calculated for constant continued release of CFM's. A.R.H.

N79-19548# Meteorological Office, Bracknell (England).
STUDIES OF STRATOSPHERIC CHEMISTRY USING A HEMISPHERIC MODEL
P. Graystone *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 233-238 refs (For primary document see N79-19522 10-46)
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The complexity of the physical, chemical, and dynamic processes operating throughout the earth's stratosphere pose considerable practical restraints and computations of perturbations are further compounded when the injection of chlorofluorocarbons into the troposphere and their percolation into the upper stratosphere must be considered in mathematical models. A low resolution two-dimensional Northern Hemisphere model was formulated incorporating a comprehensive chemistry scheme allowing for diurnal variation. Perturbations experiments still in progress suggest that significant reductions in calculated ozone concentration may be derived as a result of the injection of F11 and F12. The complex processes involved can at best be only partially simulated. Caution must be exercised in applying the results of these calculations to the real atmosphere. A.R.H.

N79-19549# Oxford Univ. (England). Clarendon Lab.
A ZONAL MEAN MODEL OF THE STRATOSPHERE INCLUDING FEEDBACK BETWEEN CHEMISTRY, RADIATION AND DYNAMICS
J. A. Pyle *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 239-245 refs Sponsored by U. K. Dept. of Environ. (For primary document see N79-19522 10-46)
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The depletion of total ozone due to chlorofluoromethanes was calculated in a two-dimensional, time-dependent model. The computed reductions show a significant variation with latitude and season. The depletion is largest in high latitudes, when ozone is a maximum, and smallest in equatorial latitudes, where ozone is a minimum. With the particular photochemical scheme used, the calculated total depletion of ozone throughout the atmosphere is a little above 0.5 per cent by the mid 1970's. When the feedback between the ozone concentration and the circulation is considered, the calculated depletions are found to change. The temperature structure of the stratosphere is modified when the ozone layer is perturbed, with the upper stratosphere cooler in the perturbed runs while the lower stratosphere is warmer. Clearly, in considering possible modifications to the ozone layer, an aim should be the development of multi-dimensional circulation models including complete treatments of the various feedback mechanisms. Author

N79-19550# Meteorological Office, Bracknell (England).
COVARIANCE AND AVERAGING OF GASES IN 1, 2, AND 3-DIMENSIONAL ATMOSPHERIC MODELS
A. F. Tuck *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 247-254 refs (For primary document see N79-19522 10-46)
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One and two-dimensional models of the sort widely used for perturbation calculations of the effect of aircraft and chlorofluoromethanes on the stratospheric ozone balance are unreliable tools for quantitative estimation of rates of gas reactions in the atmosphere. This is because nonlinear correlations, arising largely from dynamical phenomena, are either ignored or inadequately represented. The resulting errors, arising from the design of one and two-dimensional models rather than from the input data, are not included in published estimations of error limits associated with ozone perturbation calculations. Author

N79-19551# Meteorological Office, Bracknell (England).
INCREASING ATMOSPHERIC CO2 AND STRATOSPHERIC OZONE
K. S. Groves, S. R. Mattingly, and A. F. Tuck *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 255-261 refs (For primary document see N79-19522 10-46)
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An expanded and improved version of a stratospheric one-dimensional chemical kinetics model was interactively coupled with a radiative-convective column model of solar and thermal radiative transfer, which computes heating and cooling rates, and hence, temperatures. Approximate dates were associated with the increase in carbon dioxide volume mixing ratios (vmr) which results from fossil fuel burning and deforestation. The model was used to compute time dependent vertical ozone distributions as a function of CO2 vmr. Calculations reveal that an increase of CO2 in the upper stratosphere results directly in a cooling there, and a concommitant increase in ozone amounts. The seasonal phase of this ozone increase is greatest in summer. The seasonal ozone production in the upper stratosphere, following enhancement of carbon dioxide mixing ratios, is of a magnitude which is not negligible compared to reductions calculated by chlorofluoromethane emissions. A.R.H.

N79-19552# Atmospheric Environment Service, Toronto (Ontario).
THE POSSIBLE IMPACT OF PAST AND PROJECTED FUTURE ATMOSPHERIC RELEASE OF CFM'S ON STRATOSPHERIC OZONE AND ITS CLIMATE INVESTIGATED IN A 2-D TIME DEPENDENT MODEL
R. K. R. Vupputuri *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 263-267 refs Sponsored by Can. Atmospheric Environ. Service (For primary document see N79-19522 10-46)
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A two-dimensional time dependent model that simulates both the natural stratosphere and a stratosphere contaminated by a industrial chlorofluoromethanes is discussed. The photochemistry contains all the reactions that are presently known to be important in the stratosphere, including the reactions involving C1NO3 and the reaction of HO2 with NO. Model simulations are compared with available observations. Predicted changes in ozone, temperature, and other minor trace constituents due to the past and future release of CFM's into the atmosphere are represented. A.R.H.

N79-19553# Atmospheric Environment Service, Toronto (Ontario).
POTENTIAL EFFECTS OF NOx PERTURBATIONS ON THE STRATOSPHERE INCLUDING THE REACTION OF HO2 WITH NO INVESTIGATED IN A 2-D TIME DEPENDENT MODEL
R. K. R. Vupputuri *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 269-273 refs Sponsored by Can. Atmospheric Environ. Service (For primary document see N79-19522 10-46)
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The problem of the impact of nitrogen oxide perturbations due to high latitude aircraft emissions on stratospheric structure and ozone distribution was investigated using a two dimensional time dependent model taking into account the reaction HO2+NO yields HO+NO with most recently measured value of the reaction rate coefficient. Three types of experiments are carried out by changing the solar declination everday and evaluating the daily mean radiation integrals for the relevant minor constituents. The first experiment consists of the normal stratosphere incorporating the radiative-photochemical processes in an oxygen-hydrogen-nitrogen evironment atmosphere. The second was identical to the first except the nitrogen oxide was injected at a rate of 1.8 MT/YR at an altitude of roughly 21 km in the summer hemisphere. The third experiment is similar to the second except that the nitrogen oxide injection rate was change to 0.35 MT/YR and the altitude of injection to 18.5 km. In both perturbation experiments, nitrogen oxide emission were treated as a function of latitude. In both cases the integration was started from previously computed steady state solutions for the natural stratosphere. A.R.H.

N79-19554# California Univ., Livermore. Lawrence Livermore Lab. Lawrence Livermore Lab.

EFFECTS OF STRATOSPHERIC PERTURBATIONS ON THE SOLAR RADIATION BUDGET

Frederick M. Luther *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 277-284 refs (For primary document see N79-19522 10-46)
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Changes in O3 and NO2 concentrations due to an injection of nitrogen oxide lead to increases in the total solar absorption of both species. These increases are small when compared with to the total energy absorbed by the stratosphere, and the climatic effect is estimated to be negligible. Using the criteria that changes in surface temperature less than 0.1 K would not have major consequences, none of the SST engine emissions is estimated to have a major climatic effect. The combined effect of all engine emissions on climate is likely to be an increase in global mean temperature of less than 0.1K. In the case of CFM perturbation, there is a significant impact on the solar radiation budget leading to a decrease in solar heating of the stratosphere and an increase in the solar heating of the troposphere and the Earth's surface. There is also an increase in the solar flux scattered back to space. The greenhouse effect of CFCl3 and CF2Cl2 tends to warm the surface, possibly as much as 0.4 K. The net effect of surface temperature is uncertain, but may be in excess of plus or minus 0.1K, which would be considered significant. A.R.H.

N79-19555# Environmental Protection Agency, Washington, D. C

REGULATORY DECISION-MAKING USE OF SCIENTIFIC INFORMATION

Herbert L. Wiser *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 285-287 (For primary document see N79-19522 10-46)
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Policy and decision makers consider and weigh all pertinent factors and therefore, must have all relevant information available to them. They do not necessarily require extremely precise data, but knowledge of the magnitude or bounds of the uncertainty is important. Decision-makers need to know the error bars on data, the upper and lower bounds, the completeness or incompleteness of the models or theories, and any qualifying assumptions underlying the models or analyses. Specific information of value to policy-makers entrusted with protecting human life and other biological species include: (1) the minimum detectable change in stratospheric ozone concentrations and its natural fluctuations and deviations; (2) the expected ozone change; (3) physical and chemical impacts of other substances or the activities of man on the stratosphere; and (4) the impact of chemical aerosols in the atmosphere which alter radiative processes and effect climate. A.R.H.

N79-19556# Orleans Univ. (France). Centre de Recherches sur la Chimie et des Hautes Temperatures.

ELEMENTARY REACTIONS OF Cl AND ClO RADICALS WITH HYDROGENATED SPECIES OF STRATOSPHERIC INTEREST

G. Poulet, G. LeBras, and J. Combourieu *In* WMO Geophys. Aspects and Consequences of Changes in the Composition of the Stratosphere 1978 p 289-294 (For primary document see N79-19522 10-46)
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Rate constant determinations were made for the reactions of Cl atoms with HNO3, CH4, H2O2 and HO2. The relative importance of these reactions are discussed and the rates of removal of Cl and ClO at stratospheric altitudes are estimated. A.R.H.

N79-19557# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.

CO-ORDINATED ANALYSIS OF AURORAL DATA ON THE ATS FIELD LINE Final Report, 30 Jun. 1976 - 31 Mar. 1978

Robert H. Eather 31 Aug. 1978 52 p refs
(Contract F44620-76-C-0129)
(AD-A062033; AFOSR-78-1501TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report describes data analysis of meridian-scanning photometer data and satellite particle data, taken on the ATS field line. The particles that generate diffuse aurora are identified. A complete absolute calibration of the DMSP imaging system is presented. Ongoing co-ordinated analysis is described. Author (GRA)

N79-19558# Defence Research Establishment Pacific, Victoria (British Columbia).

THE DREP QMIS GEOMAGNETIC MICROPULSATION DATA RECORDS, 1969 TO 1974: THEIR CONTENT AND INTERPRETATION

J. A. Shand Apr. 1978 19 p
(AD-A061738; DREP-TM-78) Avail: NTIS HC A02/MF A01 CSCL 08/14

A set of 25 digital magnetic tapes contain the better part of five years: single-component quantitative geomagnetic micropulsation information recorded at a quiet site in Southern Alberta. These tapes, derived from the original records, now exist in a standard, readable format. Author (GRA)

N79-19559# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.

PRECEDE II: SUMMARIZED RESULTS OF AN ARTIFICIAL AURORAL EXPERIMENT

Robert R. ONeil, ed. 16 Mar. 1978 75 p ref Sponsored in part by DNA
(AF Proj. 7670)
(AD-A061717; AFGL-TR-78-0063; AFGL-ERP-627; DNA-HAES-77) Avail: NTIS HC A04/MF A01 CSCL 04/1

On 13 December 1977, PRECEDE II was launched from the White Sands Missile Range, New Mexico at 05:49:59.116 UT. PRECEDE II is one of a series of artificial auroral experiments in the DNA-AFGL EXCEDE program using pulsed high-power rocketborne electron accelerators operating in the 80- to 140-km altitude range. This launch was designed to serve as an engineering test of an electron accelerator module providing a pulsed 3-kV, 7-A electron beam, to provide an engineering test for a newly designed liquid nitrogen cooled rocketborne infrared Michelson interferometer, and to observe the ultraviolet and visible emissions induced in the night sky by the rocketborne electron source with a number of ground based imaging, spectrographic and photometric instruments. This report briefly describes the scope of the PRECEDE II experiment and summarizes the performance of the various instruments. Author (GRA)

N79-19560# Weston Observatory, Mass.

RESEARCH ON THE NATURE OF GROUND TILTS IN THE PERIOD RANGE ONE THOUSAND TO TEN MILLION SECONDS Final Report, 1 Oct. 1975 - 30 Sep. 1977

Robert K. McConnel, Jr. and James Lewkowicz 21 Apr. 1978 59 p refs
(Contract F19628-76-C-0073)
(AD-A061476; AFGL-TR-78-0105) Avail: NTIS HC A04/MF A01 CSCL 08/3

The apparent tidal tilt anomaly first identified at Bedford, Massachusetts is shown to extend to Maynard approximately 17km WSW and to be attributable to ocean tide loading effects. The analysis technique used has been demonstrated to be capable of determining the M sub 2 tide with a standard deviation of 2 nanoradians using a single months data. Evidence is presented that the observed atmospheric pressure effects are site rather than instrumental in nature. While stability of individual deep borehole installations is substantially better than for shallow installations local effects still mask true secular ground movement. The nature of the tilt records is such that simple averaging will not significantly improve the secular tilt estimates. It appears that new techniques capable of recognizing only those effects which act simultaneously on all tiltmeters are required. Author (GRA)

N79-19561# Washington Univ., Seattle. Dept. of Oceanography.

FLUCTUATIONS IN GEOPHYSICAL AND BOUNDARY LAYER FLOWS Final Report, 1 Aug. 1973 - 31 Jul. 1978

William O. Criminale, Jr. Oct. 1978 11 p
(Grant AF-AFOSR-2579-74)

(AD-A061924; AFOSR-78-1482TR) Avail: NTIS HC A02/MF A01 CSCL 04/1

The study of fluctuations in geophysical-type flows is the central issue of the work pursued under the auspices of this proposal. By appropriate modeling, an understanding is sought for (1) the processes that control and originate the transfer of energy, momentum, or mass in the atmosphere and (2) large-scale instabilities in both ordinary and atmospheric boundary layers. Besides investigating transition conditions, general effects of body forces (rotation of the earth in this case) on turbulence generation in such a shear flow are explored. Author (GRA)

N79-19562# Naval Research Lab., Washington, D. C. Plasma Physics Div.

ESTIMATING THE SPECTRUM OF ELECTRON DENSITY FLUCTUATIONS FROM SIMULATIONS OF IONOSPHERIC PLASMA CLOUDS Interim Report

Norman J. Zabusky and Joseph Block Jul. 1978 70 p Sponsored by DNA

(AD-A061910; NRL-MR-3586) Avail: NTIS HC A04/MF A01 CSCL 04/1

Numerical simulations of ionospheric plasma clouds yield information for four related purposes: To interpret past barium cloud experiments; To predict phenomena in new experiments; To validate algorithms used in system codes which determine the life-time of sky regions occluded by striations following a nuclear explosion; and to predict the temporal evolution of the spectrum of electron-density fluctuations (EDF's) for use in propagation studies. In this memorandum the spectrum of simple geometric figures that have shapes similar to those that arise in the evolution of ionospheric plasma clouds is studied. GRA

N79-19563# Oregon State Univ., Corvallis. Sea Grant Coll. Program.

GEOTHERMAL RESOURCES FOR AQUACULTURE

Sep. 1978 51 p Workshop held in Boise, Idaho, 13-15 Dec. 1977 Sponsored by NOAA

(PB-290345/8; ORESU-W-78-001; NOAA-78102401) Avail: NTIS HC A04/MF A01 CSCL 08G

The workshop sought consensus on the potential of geothermal aquaculture for commercial success. Geothermal sites in the United States Pacific Northwest may represent useful locations for commercial freshwater aquaculture. Awareness of this opportunity stems from the research observation that warmed water increases growth rates of certain species of fish and shellfish, and from the fact that some of these geothermal sites have already been tapped for electric power generation and other uses. Questions addressed included: what species can or should be produced; what biological constraints exist through nutrition, disease, or husbandry, and what engineering, economic, marketing, or institutional and legal problems must be solved. Research, training, and advisory needs were identified and priorities described. GRA

N79-19564# Nebraska Univ., Lincoln. Ross Ice Shelf Project Management Office.

INITIAL REPORT ON GEOLOGICAL MATERIALS COLLECTED AT RISP SITE J9(1977-1978)

Peter-Noel Webb Sep. 1978 52 p refs Prepared in cooperation with Univ. of Northern Ill., De Kalb

(Grant NSF DPP-76-20891)

(PB-288454/2; RISP/TR-78/1) Avail: NTIS HC A04/MF A01 CSCL 08G

The Ross Ice Shelf, Antarctica, occupies 540,000 square kilometers and is the world's largest ice shelf. At Ross Ice Shelf Project site J-9 (82 degrees 22 minutes south latitude, 168 degrees 40 minutes west longitude) a hole was drilled through the 420-meter-thick ice shelf and 11 gravity cores, 10 sphincter cores, and one dredge sample were collected. Deepest penetration was 102 centimeters. Preliminary results indicate that fossil-rich mid Miocene glaciomarine sediments are exposed at the sea floor. There is no apparent Pliocene or Pleistocene exposed, presumably the result of recent grounding and erosion during the latest phase of Ross Ice Shelf history. The report discusses core recovery and curation, describes the cores and the geology at the site, and presents preliminary paleontological results. GRA

N79-19565# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.

DETERMINING MODELS OF STRUCTURES FROM EARTHQUAKE RECORDS Ph.D. Thesis

James Leslie Beck Jun. 1978 309 p refs

(Grant NSF ENV-77-23687)

(PB-288806/3; EERL-78-01) Avail: NTIS HC A14/MF A01 CSCL 13M

The problem of determining linear models of structures from seismic response data is studied using ideas from the theory of system identification. The investigation employs a general formulation called the output-error approach, in which optimal estimates of the model parameters are obtained by minimizing a selected measure-of-fit between the responses of the structure and the model. Two output-error techniques are investigated. Tests of the first, and optimal filter method, show that its advantages are offset by weaknesses which make it unsatisfactory for application to seismic response. A new technique, called the modal minimization method, is developed to overcome these difficulties. The modal minimization method is applied to two multi-story buildings that experienced the 1971 San Francisco earthquake. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-19566 California Univ., Berkeley.

A METEOROLOGICAL ANALYSIS OF THE VARIABILITY OF PRECIPITATION IN THE GREAT PLAINS, USA Ph.D. Thesis

John Paul Monteverdi 1978 128 p

Avail: Univ. Microfilms Order No. 7904553

Precipitation variability was studied in a region in the Great Plains which is normally characterized by marginal precipitation. Total precipitation variability, defined as the sum of the squares of the temporal and areal variabilities, was found to have a significant northward decrease across the study area. The latitudinal variation of areal variability was shown to be negligible, so it was concluded that the gradient of the total variability was proportional to the gradient of temporal variability across the Plains. Dissert. Abstr.

N79-19567 Purdue Univ., Lafayette, Ind.

DIAGNOSTIC ANALYSES OF INITIALIZED AND SHORT RANGE FORECAST FIELDS DERIVED FROM THE NCAR GENERAL CIRCULATION MODEL Ph.D. Thesis

John Henry Ward 1978 168 p

Avail: Univ. Microfilms Order No. 7905790

Diagnostic analyses of initialized and short range forecast fields derived from the National Center for Atmospheric research's (NCAR) general circulation model were performed by means of kinetic energy budget analyses. Two sets of objectively-analyzed data, one produced from the National Meteorological Center's Cressman objective analysis scheme and the second produced from NCAR's multivariate statistical objective analysis scheme, were examined, both before and after the initialization process. Even though substantial differences existed between these two methods, subsequent forecasts prepared from the two initialized fields were very familiar. Analyses confirmed that a substantial amount of kinetic energy is lost during initialization and continues through the subsequent forecast periods. It is shown that much of this energy loss is in the geostrophic component of the flow. Dissert. Abstr.

N79-19568# Battelle Pacific Northwest Labs., Richland, Wash.

WIND CHARACTERISTICS PROGRAM ELEMENT Annual Report, Jul. 1977 - Jul. 1978

L. L. Wendell, J. R. Connell, W. T. Pennell, D. S. Renne, and H. L. Wegley Dec. 1978 130 p refs

(Contract EY-76-C-06-1830)

(PNL-2545; UC-60) Avail: NTIS HC A07/MF A01

This annual report to the wind systems branch of the Department of Energy's (DOE's) Division of Distributed Solar

Technology describes the technical progress within each program area from July 1977 through July 1978. The progress is presented which was accomplished directly by PNL, by other DOE laboratories and by contractors funded directly by DOE or through PNL. The wind velocity change criteria for wind turbine design along with techniques for incorporating data into large area analysis are discussed. The publications on methodology for small wind energy conversion and wind forecasts are also reported.
M.M.M.

N79-19569*# National Weather Service, Camp Springs, Md.
SYNOPTIC ANALYSES, 5-, 2-, 1-, AND 0.4-MILLIBAR SURFACES FOR JULY 1976 THROUGH JUNE 1977
Dec. 1978 226 p refs
(NASA Order P-59946-G)
(NASA-RP-1032) Avail: NTIS HC A11/MF A01 CSCL 04B
Meteorological rocketsonde and satellite radiance data are employed for analyses of a continuing series of high-altitude constant-pressure charts. The automated methods of data processing and the objective analysis procedures are described. Broad-scale analyses of temperature and geopotential height for the Northern Hemisphere 5-, 2-, 1-, and 0.4-mb surfaces are presented for each week of the period July 1976 through June 1977. Brief discussions of the variations of the temperature and height fields throughout the period are also given. Author

N79-19570# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), KANEOCHE BAY, HI Reference Report, 1945 - 1977
Jul. 1978 356 p
(AD-A062044) Avail: NTIS HC A16/MF A01 CSCL 04/2
Surface weather observations are presented in tables.
M.M.M.

N79-19571# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), YUMA, ARIZONA Reference Report, 1948 - 1977
Jul. 1978 465 p refs
(AD-A062047) Avail: NTIS HC A20/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-19572# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), GLENVIEW, ILLINOIS Reference Report, 1945 - 1977
Jul. 1978 370 p refs
(AD-A062042) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-19573# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), SAN CLEMENTE, CALIFORNIA Reference Report, 1963 - 1977
Jul. 1978 356 p
(AD-A062041) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-19574# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), MIDWAY ISLAND Reference Report, 1949 - 1977
Jul. 1978 355 p refs
(AD-A062040) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-19575# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), GUANTANAMO BAY, CUBA Reference Report, 1945 - 1977
Jul. 1978 389 p refs
(AD-A062046) Avail: NTIS HC A17/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-19576# Naval Weather Service Detachment, Asheville N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), BEAUFORT, SC Reference Report, 1957 - 1977
Jun. 1978 370 p
(AD-A062049) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-19577# Naval Research Lab., Washington, D. C. Atmospheric Physics Branch.
REAL-TIME METEOROLOGICAL PROFILES USING THE NRL MARINE BOUNDARY LAYER SONDE Interim Report
Stuart G. Gathman 24 Oct. 1978 19 p refs
(WF52551715)
(AD-A061718; NRL-8371) Avail: NTIS HC A02/MF A01 CSCL 04/2
A radiosonde system capable of real-time analog display as well as digital recording has been designed for use on tethered vehicles. A very simple configuration of the system, consisting of only the transmitter unit, an AM radio receiver, and a stopwatch, can produce useful data. When used with a commercial microcomputer system, the system can provide real-time display and digital recordings. The system obtains information on the marine boundary layer from measurements of pressure altitude, air temperature, and wet-bulb temperature throughout the lowest 600 m of atmosphere as it ascends and descends between the surface and its maximum altitude. Author (GRA)

N79-19578# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 12828F LANCE, MISSILE NUMBER 2219, ROUND NUMBER 320 DST
Nov. 1978 50 p
(AD-A062000; ECOM-DR-979) Avail: NTIS HC A03/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 12828F Lance, Missile number 2219, Round number 320 DST, are presented in tabular form. Author (GRA)

N79-19579# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), NEW ORLEANS, LOUISIANA Reference Report, 1958 - 1977
Jul. 1978 365 p
(AD-A062043) Avail: NTIS HC A16/MF A01 CSCL 04/2
Climatological data for this period are presented. S.E.S.

N79-19580# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), YOKOSUKA, JAPAN Reference Report, 1953-1977
Jul. 1978 353 p
(AD-A062045) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-19581# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), WHIDBEY ISLAND, WA. Reference Report, 1945 - 1977
Jul. 1978 367 p
(AD-A062048) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-19582# Eddy (Amos), Inc., Norman, Okla.
THE EFFECTS OF RAIN GAGE DENSITIES ON THE ANALYSIS OF STORM TOTAL RAINFALL FROM CONVECTIVE COMPLEXES Final Report, 1 Jun. 1977 - 30 Sep. 1978
Amos Eddy and Louis Hembree 1 Oct. 1978 86 p
(Contract DI-7-07-83-V0007)
(PB-288890/7) Avail: NTIS HC A05/MF A01 CSCL 04B
The Eddy Statistical Objective Analysis algorithm was subjected to intensive testing: (1) by performing a worst case bivariate objective analysis of storm total rainfall volume using radar reflectivities and rain gage data on a very small Montana convective complex selected by Bureau of Reclamation personnel, (2) by using a simulated storm signal generator to test the univariate (gage only) analysis algorithm for sensitivity to sampling density wherein the gage observations were taken on a regular network, (3) by analyzing two ensembles of simulated gage-only observation sets provided by the Bureau of Reclamation for comparison with the results from other analysis techniques. Between-storm discrimination techniques are discussed. GRA

N79-19583# National Weather Service, Salt Lake City, Utah.
SOLAR RADIATION
John A. Jannuzzi Nov. 1978 47 p
(PB-291195/6; NOAA-TM-NWS-WR-134; NOAA-78120502)
Avail: NTIS HC A03/MF A01 CSCL 04A
Central source of solar information and a reference for weather data necessary for solar users are published. The report is broken down into two main parts. Section 1 discusses uses and methods of use of solar energy. Section 2 deals with the impact of weather and climate on solar use. Weather information necessary for the user of various solar methods is discussed and sources of this information are given. GRA

N79-19584# National Weather Service, Los Angeles, Calif.
ESTIMATES OF THE EFFECTS OF TERRAIN BLOCKING ON THE LOS ANGELES WSR-74C WEATHER RADAR
R. G. Pappas, R. Y. Lee, and B. W. Finke Oct. 1978 12 p ref
(PB-289767/6; NOAA-TM-NWS-WR-132; NOAA-78111306)
Avail: NTIS HC A02/MF A01 CSCL 04B
The Los Angeles WSR-74C radar was installed in early 1978 on top of the Federal Building in west Los Angeles, California. This location is in an area adjacent to mountainous terrain. The Pappas technique was programmed in BASIC and run on a microcomputer for application to this radar site. The program listing is given as well as an example of the output. The result of plotting the entire output is presented on a map of the area. This provides an easy reference to refer to when determining areas of poor detection or when ascertaining capability of radar to see over particular drainages. The map shows extensive blocking in the west-through-through-east sector. Less severe blocking occurs to the south and east-southeast. GRA

N79-19585# National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.
A NUMERICAL SIMULATION OF HURRICANE LANDFALL
Michael S. Moss and Robert W. Jones Nov. 1978 22 p refs
(PB-290398/7; NOAA-TM-ERL-NHEML-3; NOAA-78121102)
Avail: NTIS HC A02/MF A01 CSCL 04B
A three-dimensional, three-level, nested grid numerical model were used in a landfall simulation experiment. The model storm was advected over a north-south coastline by an easterly environmental current of approximately 5 m/s. Before landfall, the track was to the left and after landfall to the right, of that in a control that was run without the coastline. Some of the other responses to landfall are: (1) the central pressure began to rise in the core region before landfall, a transient wind speed maximum was established on the landward side of the vortex, (2) the center of the surface circulation was markedly elliptical, with the major axis oriented normal to the coastline, and (3) a strong area of convection moved north and crossed the coast to the right of the storm path during landfall. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-19586 Alaska Univ., College.
COPPER IN THE SEA: A PHYSICAL-CHEMICAL STUDY OF RESERVOIRS, FLUXES AND PATHWAYS IN AN ALASKAN FJORD Ph.D. Thesis
David Thomas Heggie 1977 228 p
Avail: Univ. Microfilms Order No. 7906091
Copper in the sea is derived principally from continental weathered products added to the oceans at continental boundaries, hence processes, fluxes and pathways in estuaries control the supply of copper to the marine biosphere. From mass balances, the fluxes, sources and sinks of copper in an Alaskan fjord were examined, by utilizing fjord deep waters as an approximation to a closed chemical system. Copper was measured in the water columns and interstitial waters electroanalytically with a precision of 10%. Approximately 40% of total copper was associated with particulate matter in the water column. Concentrations of copper on sediments were about 20 mg/kg. Copper was removed from the water column and transported to the sediments by particulate matter. Dissert. Abstr.

N79-19587*# Computer Sciences Corp., Silver Spring, Md.
A SURVEY OF POTENTIAL USERS OF THE HIGH ALTITUDE POWERED PLATFORM (HAPP) IN THE OCEAN/COASTAL ZONE COMMUNITY Final Report
David Escoe and Paul Rigternik Mar. 1979 67 p refs
(Contract NAS6-2369)
(NASA-CR-156852; CSC/TM-78/6331) Avail: NTIS HC A04/MF A01 CSCL 08C
The results of a survey of the ocean/coastal zone community to determine potential applications of a High Altitude Powered Platform (HAPP) are reported. Such a platform, capable of stationkeeping for periods up to a year over a given location, could make frequent and repeated high resolution observations over a given region or serve as a high-altitude regional communications link. Users were surveyed in person and via a questionnaire to determine the desirability of the HAPP within the ocean/coastal

zone community. The results of the survey indicated that there is strong interest in all areas of the user community (research and development, operational agencies, and private industry) in having NASA develop the HAPP. G.Y.

N79-19588# National Weather Service, Salt Lake City, Utah. Western Region.
SPECTRAL TECHNIQUES IN OCEAN WAVE FORECASTING
John A. Jannuzzi Oct. 1978 69 p refs
(PB-291317/6; NOAA-TM-NWS-WR-133; NOAA-78120501)
Avail: NTIS HC A04/MF A01 CSCL 08C

Weather Bureau Technical Memorandum (WBTM) WR-51 Western Region Sea State and Surf Forecaster's Manual was prepared as a ready-reference for operational techniques of wind wave, swell, and breaker forecasting. The significant wave forecast technique developed by Svedrup-Munk-Bretschneider (S-M-B) was used. This method was described for use by forecasters who did not have access to computer facilities. GRA

N79-19589# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
OCEAN THERMAL AND VELOCITY CHARACTERISTICS OF THE GULF OF MEXICO RELATIVE TO THE PLACEMENT OF A MOORED OTEC PLANT
Robert L. Molinari and John F. Festa Oct. 1978 191 p refs Sponsored in part by DOE
(PB-289796/5; NOAA-TM-ERL-AOML-33) Avail: NTIS HC A09/MF A01 CSCL 08J

The results of a four stage effort designed to provide ocean thermal and velocity data in the Gulf of Mexico for OTEC are presented. The four stages are: (1) to define ocean thermal and velocity data requirements for OTEC design and impact studies; (2) review the historical data-set and literature for relevant inforamtion; (3) design a measurement and/or data reanalysis program; and (4) conduct the measurement and/or reanalysis program. Knowledge concerning the Gulf structures is summarized. GRA

N79-19590# Connecticut Univ., Storrs. Inst. of Water Resources.
SEDIMENTATION AND MICROBIAL METABOLISM IN A SHALLOW ESTUARY
J. D. Buck Oct. 1978 31 p refs
(Contract DI-14-31-0001-6007)
(PB-288652/1; W79-01091; OWRT-A-069-CONN(1)) Avail: NTIS HC A03/MF A01 CSCL 08A

A pristine, forested coastal watershed (18 km) in southern New England was studied for three years to determine (1) the effect of a small (22 ha) drinking water reservoir on nutrient and water runoff, and (2) the relative importance of the watershed in supplying organic sediment to the receiving estuary (29 ha). Organic and inorganic freshwater runoff data were supplemented with estuarine sedimentation rate data to construct a first-order organic supply budget for the estuary. The reservoir system retained significant amounts of dissolved and particulate organic carbon and NO3-N but O-PO4-P runoff was unaffected. Chemistry of the interstitial pore waters of the estuarine sediments showed that organic matter deposition rates and the ambient hydrologic regime induce facultative and anaerobic metabolism by the microflora. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-19591 State Univ. of New York at Buffalo.
STUDY OF MODEL MEMBRANE FUSION USING PHOTON CORRELATION SPECTROSCOPY Ph.D. Thesis
Shao-Tang Sun 1978 88 p
Avail: Univ. Microfilms Order No. 7905325

The kinetics and extent of fusion of phospholipid vesicles - model biomembranes were studied. The temperature dependence of calcium-induced fusion of phosphatidylserine vesicles and phosphatidylserine/phosphatidylcholine mixtures was measured to determine the relationship between vesicle fusion and bilayer phase transition. Sonicated vesicles were incubated for several hours at constant temperatures in the presence of a specific calcium concentration. The chelating agent EDTA was then added. The average size of the resulting large vesicles was measured using photon correlation spectroscopy. This final vesicle size served as a measure of the extent of the calcium-induced fusion during incubation. The graph of this extent of fusion against incubation temperature showed a sharp maximum at the bilayer phase transition temperature which unequivocally gives the first direct evidence of the importance of phase transition in the fusion process. Dissert. Abstr.

N79-19592*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
RADAR, INSECT POPULATION ECOLOGY, AND PEST MANAGEMENT
Charles R. Vaughn, ed., Wayne Wolf, ed. (Dept. of Agriculture, Beltsville, Md.), and Waldemar Klassen, ed. Mar. 1979 252 p refs Workshop held at Wallops Island, Va., 2-4 May 1978; sponsored in part by US Dept. of Agriculture
(NASA-CP-2070) Avail: NTIS HC A12/MF A01 CSCL 06C

Discussions included: (1) the potential role of radar in insect ecology studies and pest management; (2) the potential role of radar in correlating atmospheric phenomena with insect movement; (3) the present and future radar systems; (4) program objectives required to adapt radar to insect ecology studies and pest management; and (5) the specific action items to achieve the objectives. For individual titles, see N79-19593 through N79-19604.

N79-19593*# North Carolina State Univ., Raleigh.
THE ROLE OF INSECT DISPERSAL AND MIGRATION IN POPULATION PROCESSES
R. L. Rabb and R. E. Stinner *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 3-16 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 06C

Movement functions in the population dynamics of insects are discussed. Modes of movement, movement from a population view, and population patterns are described and predicted. A wide-area of spatial and temporal patterns are presented. S.E.S.

N79-19594*# California Univ., Riverside.
SHORT-RANGE MOVEMENT OF MAJOR AGRICULTURAL PESTS
Robert VanSteenwyk *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 17-21 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 06C

Visual observations of population fluctuations which cannot be accounted for by either mortality or natality are presented. Lygus bugs in the westside of the San Joaquin Valley of California are used as an example. The dispersal of most agricultural pests in one of the less known facets of their biology is discussed. Results indicate a better understanding of insect movement is needed to develop a sound pest management program. S.E.S.

N79-19595*# Department of Agriculture, Phoenix, Ariz.
SELECTED EXAMPLES OF DISPERSAL OF ARTHROPODS ASSOCIATED WITH AGRICULTURAL CROP AND ANIMAL PRODUCTION
T. J. Henneberry *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 23-33 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 06C

The economic importance of arthropods in agricultural production systems and the possibilities of using dispersal behavior to develop and manipulate control are examined. Examples of long and short distance dispersal of economic insect pests and beneficial species from cool season host reservoirs and overwintering sites are presented. Significant dispersal of these species often occurring during crop and animal production is discussed. S.E.S.

N79-19596*# Forest Service, Hamden, Conn.
DISPERSAL OF FOREST INSECTS
Michael L. McManus *In* NASA. Wallops Flight Center Radar,

Insect Population Ecology, and Pest Management Mar. 1979 p 35-39 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 06C

Dispersal flights of selected species of forest insects which are associated with periodic outbreaks of pests that occur over large contiguous forested areas are discussed. Gypsy moths, spruce budworms, and forest tent caterpillars were studied for their massive migrations in forested areas. Results indicate that large dispersals into forested areas are due to the females, except in the case of the gypsy moth. S.E.S.

N79-19597*# Department of Agriculture, Beltsville, Md.
STRATEGIC AND TACTICAL USE OF MOVEMENT INFORMATION IN PEST MANAGEMENT
E. F. Knipling *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 41-57 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 06C

Several insect movement problems are discussed. Much more information is needed to make a better appraisal of the practical significance of the insect dispersal problem. Data on the time, rate, and extent of movement of insects are provided. Better techniques for measuring insect movement are developed. A better understanding of the importance of insect movement in the development and implementation of more effective and ecologically acceptable pest management strategies and tactics was proved. S.E.S.

N79-19598*# Naval Research Lab., Washington, D. C. Radar Div.
CAPABILITIES OF RADAR AS THEY MIGHT RELATE TO ENTOMOLOGICAL STUDIES
Merrill I. Skolnik *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 61-79 (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 06C

A tutoral background of radar capabilities and its potential for insect research is provided. The basic principles and concepts of radar were reviewed. Information on current radar equipment was examined. Specific issues related to insect research included; target cross-section, radar frequency, tracking target recognition and false alarms, clutter reduction, radar transmitter power, and ascertained atmospheric processes. S.E.S.

N79-19599*# Centre for Overseas Pest Research, London (England).
POSSIBLE IMPACT OF RADAR ON PEST MANAGEMENT OPERATIONS
R. C. Rainey *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 81-86 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 06C

Radar in making and maintaining contact with the most important populations of major pests in different stages of flight is presented. The desert locust and the African armyworm are discussed in understanding problems and developing a more effective control of pests. S.E.S.

N79-19600*# Army Electronics Command, Fort Monmouth, N. J.
RADAR OBSERVATION OF INSECTS: MOSQUITOES
Emerson Frost (Rutgers Univ.) and Jere Downing *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 87-112 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 06C

Tests were conducted at several sites over the coastal lowlands of New Jersey and over a region of high plains and low mountains in Oklahoma. In one area, a salt marsh in New Jersey, extensive ground tests were combined with laboratory data on expected insect backscatter to arrive at an extremely convincing model of the insect origin of most Dot Angels. A great deal of insight was studied from radar on the buildup and dispersal of insect swarms, since radar can follow where other means of trapping and observation cannot. Data on large-scale behavior as a function of wind and topography are presented. Displayed techniques which show individual or small swarm motion within some larger cloud or mass, or which can show the overall motion over great distances were developed. The influence of wind and terrain on insect motion and dispersal is determined from radar data. S.E.S.

N79-19601*# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
RADAR OBSERVATION OF KNOWN AND UNKNOWN CLEAR ECHOES **c32**
Kenneth M. Glover and Thomas G. Konrad (Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.) *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 113-130 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 17I

Target cross-section as a function of wavelength for known insects, known bird, and dot targets is presented. Tracking data using the time series analysis was tabulated for known birds. Examples were selected from these early works to give entomologists some indication of the types of information that are available by radar as well as examples of the different sources of clear-air radar backscatter. S.E.S.

N79-19602*# Royal Signals and Radar Establishment, Malvern (England). Radar Unit.
QUANTITATIVE ANALYSIS OF RADAR RETURNS FROM INSECTS **c32**
J. R. Riley *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 131-158 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 17I

When a number of flying insects is low enough to permit their resolution as individual radar targets, quantitative estimates of their aerial density are developed. Accurate measurements of heading distribution using a rotating polarization radar to enhance the wingbeat frequency method of identification are presented. S.E.S.

N79-19603*# Department of Agriculture, Phoenix, Ariz. Western Cotton Research Lab.
RADAR PROGRAM AT WESTERN COTTON RESEARCH LABORATORY **c32**
Wayne Wolf *In* NASA. Wallops Flight Center Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 159-160 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 17I

An entomological radar similar to those used in England is developed. The radar will detect insects in flight and the data will be used for studying insect dispersal. S.E.S.

N79-19604*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
THE NASA RADAR ENTOMOLOGY PROGRAM AT WALLOPS FLIGHT CENTER **c32**
Charles R. Vaughn *In its* Radar, Insect Population Ecology, and Pest Management Mar. 1979 p 161-169 refs (For primary document see N79-19592 10-51)
Avail: NTIS HC A12/MF A01 CSCL 17I

NASA contribution to radar entomology is presented. Wallops Flight Center is described in terms of its radar systems. Radar tracking of birds and insects was recorded from helicopters for airspeed and vertical speed. S.E.S.

N79-19605# Advisory Group for Aerospace Research and Development, Paris (France).
OPERATIONAL HELICOPTER AVIATION MEDICINE
S. C. Knapp, ed. (Army Aeromed. Res. Lab.) Dec. 1978 614 p refs In ENGLISH and FRENCH Meeting held at Fort Rucker, Ala., 1-5 May 1978
(AGARD-CP-255; ISBN-92-835-0226-4) Avail: NTIS HC A99/MF A01

Aviation medicine topics unique to helicopters, helicopter operations, and the aircrew who fly helicopters are discussed. Specific topics covered include: medical aspects of evacuation and search and rescue operations; environmental aspects of helicopter operations; helicopter operations crew fatigue; human factors of helicopter design and operations; visual and acoustic aspects of helicopter design and operations; and helicopter safety

and crashworthiness. For individual titles, see N79-19606 through N79-19666.

N79-19606# German Army Hospital, Munich (West Germany). Rescue Center.

RESCUE HELICOPTERS IN PRIMARY AND SECONDARY MISSIONS **c03**

B. Gorgass, G. Frey, W. Stotz, G. Kugler, and I. Karger *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 5 p refs Prepared in cooperation with Allgemeiner Deutscher Automobil-Club-e. V, Munich, West Ger. (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The experience of the Federal Republic of Germany in the use of rescue helicopters in the civilian rescue service on a trial basis in 1967 and 1968 is summarized. The area of operations of rescue helicopter bases is considered in terms of geographical distribution of hospitals and special clinics as well as the population density and airspeed of the helicopter. The composition of the technical and medical crew, the range of functions and operation tactics, the range of patients transported, and the medical equipment onboard the rescue helicopter are among the topics covered. J.M.S.

N79-19607# Wood (William C.), Memphis, Tenn.

AEROMEDICAL EVACUATION ON THE PREDICTED EUROPEAN BATTLEFIELD: A SCENARIO IN URGENT NEED OF ATTENTION **c03**

William C. Wood *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 4 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

A program of medical evacuation using primarily ground vehicle evacuation forward of the brigade trains area is presented. It is suggested that MedEvac helicopters be used on a shuttle basis, operating between the brigade trains area and the supporting combat support hospital. It is believed that this plan will accomplish the mutually supporting goals of increasing the number of lives saved and improving helicopter ambulance survivability on the predicted European battlefield. J.M.S.

N79-19608# Maryland Inst. for Emergency Medical Services, Baltimore.

MARYLAND'S MED-EVAC HELICOPTER PROGRAM **c03**

R. Adams Cowley *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 8 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

A Med-Evac helicopter program, developed by the Maryland Institute for Emergency Medical Services in 1968 with the Maryland State Police Aviation Division, to transport patients to the Maryland Institute for Emergency Medical Services' Shock Trauma Center is described. The system was developed to reduce the high rural fatality rate. Helicopters pick up victims from the scene of accidents and speed them to special care centers which can manage severe multiple trauma and other medical problems. The helicopters are also used for interhospital transfer of critically ill and injured patients, physician emergencies, transport of premature or ill neonates, transport of medical personnel and supplies. By using the helicopters 90 percent of flight time for police work, the cost of Med-Evac transports has been kept down. The survival rate has improved since the beginning of the program to 82 percent of all transports. J.M.S.

N79-19609# German Air Force, Porz-Wahn (West Germany). Helicopter Transportation Wing.

NIGHT RESCUE OPERATION PROCEDURE OVER SEA WITH BELL UH-1D HELICOPTERS **c52**

Heinz Knoche *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 8 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

Flight physiological aspects and disorientation problems of night rescue missions with Bell UH- 1 D helicopters are shown. Countermeasures which have proved to be successful in fighting disorientation are mentioned. J.M.S.

N79-19610# Federal Armed Forces Medical Coll., Munich (West Germany).

COORDINATION OF MEDICAL ASPECTS OF THE AIR RESCUE SERVICE IN THE FEDERAL REPUBLIC OF GERMANY **c03**

H. J. Linde *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The use of specially equipped rescue helicopters in the Federal Republic of Germany to provide emergency internal and surgical treatment to patients quickly at the scene of the accident and to evacuate them by helicopter to a special clinic, if required, is discussed. The establishment of 24 air rescue stations ensuring almost complete coverage of the territory of the Federal Republic of Germany, coordination of the regulations governing the employment and equipment of all helicopters so that every patient would receive the best possible treatment under identical criteria, and the increasing number of cases requiring aeromedical evacuation by fixed-wing aircraft of tourists and employees of German firms involved in accidents in foreign countries, are among the factors considered. Guidelines specifying minimum requirements for aeromedical evacuation of sick and injured persons and the standardization of the onboard equipment for these cases are included. J.M.S.

N79-19611# Army Agency for Aviation Safety, Fort Rucker, Ala. Medical Div.

MEDICAL ASPECTS OF HELICOPTER EVALUATION AND RESCUE OPERATIONS **c03**

Daniel S. Berliner *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 3 p (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

Four areas of concern in helicopter patient movement are examined. These include: (1) knowledge of the health care provider as to the suitability of helicopter evacuation for a particular patient; (2) preparation and stabilization of patients prior to helicopter flight by the sending facility or field site; (3) inflight protection of the patient from the vibratory and noise stresses of helicopter flight and the continuation of medical monitoring and treatment while flying; and (4) knowledge by the receiving facility as to the stresses and capabilities of helicopter patient movement. Education of referring health care providers and onboard patient care attendants and standardization of inflight equipment are suggested as means to solving problems existing in these areas. J.M.S.

N79-19612# Army Aeromedical Research Lab., Fort Rucker, Ala.

AN EVALUATION OF THE EFFECTS OF A STABILITY AUGMENTATION SYSTEM UPON AVIATOR PERFORMANCE/WORKLOAD DURING A MEDEVAC HIGH HOVER OPERATION **c54**

M. G. Sanders, R. I. Burden, Jr., R. R. Simmons, M. A. Lees, and K. A. Kimball *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

A method of aiding the MedEvac pilot in performing a hover maneuver while perhaps reducing workloads was investigated. A modular, four-axes stability augmentation system (Ministab) with integrated rate attitude and heading retention was installed on the USAARL JUH-1H helicopter. Participating personnel for the project were nine US Army aviators with a total average of 1172 flight hours. The aviators hovered at 30 feet above ground level for five minutes under each of the three following flight control conditions: (1) unaided--normal hover with visual flight rules conditions; (2) using Force Trim; and (3) using the Ministab. Continuous information from twenty pilot and aircraft monitoring points was recorded on an incremental digital recorder for all flights. Multivariate analyses were performed on both aircraft status variables and control input workload/activity measures. Under the conditions tested, the stability augmentation system evaluated did not provide a clearcut improvement in flight performance and workload across all flight parameters. J.M.S.

N79-19613# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

THE BOAT THAT IS A RAFT **c03**
George P. Gillespie *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

A one man life raft that demonstrates superior water survivability characteristics, improved logistics, and improved operational interfaces is described. Characteristics of the Mini Boat include center of mass located below the center of buoyancy, comfortable support for the body, and a thermal barrier between the sea and the body. Introduction of the Mini Boat into the Naval Air fleet is discussed. J.M.S.

N79-19614# Sikorsky Aircraft, Stratford, Conn. Dept. of Engineering.
UH-60A MEDEVAC KIT **c03**
Horace T. Hone *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

A kit designed for converting the standard BLACK HAWK aircraft to medical evacuation configuration, after removal of eight troop seats is described. Four crash-attenuated litters are carried, plus a 60 Hz, 115 volt power pack that permits the use of regular hospital equipment by casualities in transit. Litters can be loaded transversely from either side of the aircraft. A lifting facility is provided for the upper litters. J.M.S.

N79-19615# Societe Nationale Industrielle Aerospatiale, Marignane (France.) Helicopter Div.
CASUALTY EVACUATION BY HELICOPTER **c03**
Louis Vachon and Wilfrid Messens *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 18 p ref In ENGLISH and FRENCH (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

Casualty evacuation procedures which allow in-flight performance of all medical actions required for reanimation and small surgery together with transmission of medical data to the hospital are described. An in-flight test of DAUPHIN, a modern ambulance installation for helicopters, on the occasion of a traffic accident simulation and, at the same time, an actual evacuation mission, is documented. A full success demonstrated the validity of the concept. J.M.S.

N79-19616# Canadian Armed Forces Base Hospital, Bushell Park (Saskatchewan).
DEVELOPMENT OF CASUALTY EVACUATION KIT FOR THE LIGHT OBSERVATION HELICOPTER (KIWA) **c03**
R. M. Goede *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 5 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The design and testing of a casualty evacuation kit utilizing the Kiowa helicopter is described. This kit consisted of a stretcher support frame, aluminum stretcher, and two rear doors with bubble extensions to ensure the necessary width to transport one patient across the rear passenger compartment. Flight testing was carried out to determine the aerodynamic characteristics of the Kiowa aircraft with the kit installed. This kit was designed to fit any Kiowa helicopter in the Canadian Forces fleet. In the event of an aircraft crash, this kit could be installed in the first available aircraft in approximately fifteen minutes. J.M.S.

N79-19617# Max-Planck-Institut, Bad Kreuznach (West Germany). Anthropotechnics Working Group.
HUMAN EXPOSURE TO MECHANICAL VIBRATION AT LYING POSTURE IN THE AMBULANCE HELICOPTER UH-1D **c54**
Heinrich Dupuis *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The vibration exposure of wounded or sick people during transportation by the UH-1D helicopter was investigated. Accelerations were measured at the mounting parts of the stretcher, at four points of transferring from the stretcher to the human body, and at two places upon the body. This was done under 11 flight situations: racing the engine, ground running, lifting up, suspense-flight, ascending-flight, horizontal-flight 60, 80, 100 and 116 kn, landing-flight and running out the engine. Effective values (rms) of acceleration and frequency analysis were used as a basis for evaluation. The vibration stress was found to be about 90% smaller when transported by helicopter than by wheeled vehicles. The middle of the three positions of the stretcher showed the relative lowest vibration comparing upper and ground position. From the mounting parts of the stretcher to the points of entrance into the body vibration decreases at about 90%. Besides low frequencies (5 to 10 Hz) high frequency vibration (30 to 50 Hz) was found. J.M.S.

N79-19618# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
PROTECTIVE APPROACHES IN THE MODERATION OF THE PHYSIOLOGICAL EFFECTS OF EXTREME AMBIENT CONDITIONS IN HELICOPTER OPERATIONS **c52**
Louis J. SantaMaria *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

To study the effectiveness of a head cooling system, three subjects were individually exposed to ambient temperature levels of 32.2 C and 40.6 C. Tests were conducted with and without head cooling under resting conditions. Under conditions of light activity simulating an increase in metabolic heat production of 150-200 KCAL/hr, only the cooling mode was used at each ambient temperature. The assessment was based on temperature and comfort sensation, skin and body temperature, heart rate and total weight loss. The moderating effects of head cooling were indicated in the setting-resting conditions; with exercise the advantages were less apparent, possibly as a result of system limitations. In the cold water phase, the encapsulating life raft (ELR) and the USN LR-1 raft were tested at three levels of air-water temperature conditions, i.e., 15.6 C/10 C, 7.2 C/1.6 C, and 2.8 C/-6/7 C, and a constant wind velocity of 25 km/hr. Two volunteer subjects were similarly equipped with minimal personal protective equipment. The advantages gained by the use of the ELR were indicated in terms of body temperatures and subjective reports even under the most stressful conditions of the program. J.M.S.

N79-19619# Army Aeromedical Research Lab., Fort Rucker, Ala.
IN-FLIGHT TOXICOLOGY OF FIXED AND ROTARY WING AIRCRAFT CREW STATIONS **c52**
Gary D. Pollard and Doris W. Hirsch *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

A system was designed and developed for the measurement of toxic gases while in flight. The system is based on the use of several instruments including a multichannel infrared spectrometer, a mass spectrometer as well as several other instruments and techniques. The techniques were applied to the evaluation of weapons gases and contamination from engine exhaust in the Utility Tactical Transport Aircraft System (UTTAS) as well as other aircraft systems. Results are presented. J.M.S.

N79-19620# German Air Force, Porz-Wahn (West Germany). Helicopter Transportation Wing.
BACKACHE IN UH-1D HELICOPTER CREWS **c52**
H. C. Schulte-Wintrop (LTK, Munster, W. Ger.) and H. Knoche *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 12 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

A questionnaire was prepared and handed to the crews (6). Out of a total of 145 pilots, flight engineers and air rescue medics questioned 40% complained of backache during flight and 51% of backache after flight. The steady RPM setting during normal flight was marked to cause discomfort in 37% of the cases as opposed to only 4% when increasing RPM. In 39% of the cases the pain was described as a lasting one. 29% reported one of short duration. In 34% it was felt in the middle of the back over the dorsal process, in 54% in the lumbar region, and in only 17% in the neck. It is concluded that the following factors are causative to backache in helicopter crews: vibration;

seating posture; draft; lack of specific exercises; and vertebral abnormalities. J.M.S.

N79-19621# Army Aeromedical Research Lab., Fort Rucker, Ala.
US ARMY AVIATION FATIGUE-RELATED ACCIDENTS, 1971 - 1977 **c03**
Gerald P. Krueger and Yvonne F. Jones *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

An accident data survey was made to determine how frequently aviator crew fatigue may have contributed to US Army aviation accidents from 1971 to 1977. All accident reports in the US Army Agency for Aviation Safety (USAAAVS) data base were reviewed. Aviator fatigue was deemed to be a contributing factor in 42 rotary wing accidents which resulted in a total of 51 fatalities and 63 personnel injuries. Fatigue contributed to 10 fixed wing accidents, resulting in three fatalities and five injuries. These fatigue related accidents are categorized by aircraft and mission type and by time of day and day of week of the accident. Pilots activities prior to the accidents which promote the likelihood of pilot fatigue contributions are described. The personnel and equipment costs of these accidents to the Army are estimated, and the relative importance of such accidents to the total US Army aviation accident picture is assessed. J.M.S.

N79-19622# Advisory Group for Aerospace Research and Development, Paris (France). Aerospace Medical Panel.
EVALUATION OF AIRCREW FATIGUE DURING OPERATIONAL HELICOPTER FLIGHT MISSION **c52**
C. Koch (Italian Air Force, Rome) and F. Monesi *In its* Operational Helicopter Aviation Med. Dec. 1978 2 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

Monitoring of physiological parameters for the assessment of workload in laboratory and also field studies is described. In-flight recordings of ECG, breathing rate and amplitude, EMG, EEG, EOG and Gz were transmitted telemetrically from the helicopter crew station to the ground receiving station. The investigators were provided with some objective data on the increase in biological cost for an Agusta/Bell 204 helicopter pilot trying to maintain a given level of performance. In fact, the same task was performed by the pilot in two successive phases of an operational flight mission, the latter being more demanding. The crucial question is which physiological parameters prove of practical value in revealing the onset of a state of acute fatigue. Undoubtedly, breathing rate and amplitude show relatively early changes with the increase in workload during helicopter flying (Pettyjohn) as well as EMG and EOG. However, adequate computerized analysis of other physiological and behavioral parameters is necessary to provide the investigator with more subtle tools for the identification of fatigue. J.M.S.

N79-19623# Army Aeromedical Research Lab., Fort Rucker, Ala.
CHANGES IN THE ROTARY WING AVIATOR'S ABILITY TO PERFORM AN UNCOMMON LOW ALTITUDE REARWARD HOVER MANEUVER AS A FUNCTION OF EXTENDED FLIGHT REQUIREMENTS AND AVIATOR FATIGUE **c54**
M. A. Lees, R. R. Simmons, L. W. Stone, and K. A. Kimball *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 14 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

Changes in man-helicopter system performance for a variety of flight maneuvers were examined. The system performance changes in the rearward hover maneuver across five days of an extended flight schedule are described. System performance is categorized into measures of the pilot's control performance, measures of the aircraft's stability, and combined measures of total system performance for each primary aircraft control channel. System performance changes across the five flight days and within the flight days were examined using multivariate analysis. Significant changes in each aircraft control channel are presented and the overall changes in system performance are discussed. J.M.S.

N79-19624# Wood (William C.), Memphis, Tenn.
IMPLEMENTATION OF A DIVISIONAL AVIATION PROGRAM TO DECREASE FLIGHT CREW FATIGUE **c52**
William C. Wood *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

A vigorous and continuing program to recognize aviator fatigue implemented in the U.S. First Armored Division in Europe is described. Aviators are given lectures which review the various stresses inherent in aviation. The two types of aviator fatigue, acute skill fatigue and chronic skill fatigue, are discussed in detail. The emphasis is on recognition by the aviators themselves of symptoms and signs of fatigue. Flight hour limitation is an important part of a crew rest program, but does not replace the other elements as presented. Prevention of fatigue and recognition of fatigue which has developed is an essential component of an aviation safety program. J.M.S.

N79-19625# Sikorsky Aircraft, Stratford, Conn.
ADVANCEMENTS IN HELICOPTER COCKPIT TECHNOLOGY **c05**
Howard P. Harper *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The requirements of future missions are discussed in terms of the need for advanced controls and displays and improvements in cockpit vision, workload, and comfort. A number of technological areas are reviewed as candidates for inclusion in an advanced cockpit. A cockpit design incorporating this technology is presented. J.M.S.

N79-19626# British Aerospace Dynamics Group, Bristol (England).
VISUAL EFFECTS OF HELICOPTER MANEUVRE ON WEAPON AIMING PERFORMANCE **c53**
P. R. Michael, T. E. Jardine, and M. K. Goom *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 15 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The problem areas associated with the guidance of command-to-line-of-sight missiles from helicopters were examined and assessed experimentally. The weapon system considered employed a sight which was stabilized in pitch and yaw and which incorporated a manually operated servocontrol for moving the sight in azimuth and elevation. Four interactions likely to degrade performance were studied. These were: (1) the simultaneous use of sight and missile controls; (2) helicopter vibration; (3) helicopter forward motion; and (4) helicopter maneuver (roll, pitch and yaw). Results of a first series of simulation experiments established that, in general, helicopter vibration and forward motion did not degrade the operators' performance and that an operator could use the sight and missile guidance controls simultaneously without loss of accuracy. However, any helicopter maneuver which caused the field-of-view through the sight to roll was found to cause considerable degradation of performance, regardless of any previous flying experience of the subjects. This effect of roll phasing (cross coupling) was investigated in a second series of simulations which contained some experiments where a system of roll compensation was used. This compensation caused the missile axes to appear and remain parallel to a graticule in the sight, and the field-of-view retained its attitude at launch throughout the engagement. Provided the compensation was able to reduce roll phasing to less than 20 deg there was no degradation in performance. J.M.S.

N79-19627# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
HUMAN FACTORS EVALUATIONS OF TODAY'S HELICOPTERS AS AN AID TO FUTURE SYSTEMS DESIGN **c54**
E. J. Lovesey *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

Methods of identifying the shortcomings of helicopter weapon systems and avionics design are discussed in terms of the interface with the operator. Cine filming, eyemark, and voice recording

are considered along with structured interviews and questionnaires. Emphasis is placed on discovery of good human features and shortcomings in order to eradicate the bad in future designs. J.M.S.

N79-19628# Hughes Helicopters, Culver City, Calif. Human Factors Engineering.
TADRAP: A COMPUTER-AIDED TECHNIQUE FOR REDUCING AIRCREW TASK ANALYSIS DATA **c54**
David E. Gobuty *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p ref (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

As part of the human factors engineering activity during design of the YAH-64 advanced attack helicopter, a technique was developed for the computer aided reduction of aircrew task analysis data. The Task Analysis Data Reduction and Analysis Program (TADRAP) begins with the processing of raw data from a classical task analysis which was structured around a five-tiered pyramidal scheme for mission description. Once coded and keypunched, TADRAP converts the task analysis data into estimates of operator workload based upon expected task completion time, plus weighted values representing the complexity factors of action cycle, sensory modality, and task position. The TADRAP facilitates task analysis validation and presents workload data in tabular form. Future plans include expanding TADRAP routines to provide computer graphics illustrations of analyzed mission profiles. J.M.S.

N79-19629# Paris V Univ. (France). Laboratoire d'Anthropologie et d'Ecologie Humaine.
THE USE OF BIOSTEREOMETRY IN HELICOPTER COCKPIT DESIGN [UTILISATION D'UNE METHODE DE BIOSTEREOMETRIE DANS LA CONCEPTION D'UN POSTE DE PILOTAGE D'HELICOPTERE] **c54**
A. Coblentz, Y. Deloison, G. Ignazi, and J. Prudent *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 19 p In FRENCH (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The functional anthropometric characteristics of French land force helicopter pilots were analyzed to define new norms for equipping pilot stations and making them adaptable to the needs of the operators. An apparatus was developed which can be raised by each anatomic point and by each point chosen on the equipment. A simulator of the pilot station was constructed so that the X, Y, Z coordinates could be obtained in a fixed reference geometry. The precise results obtained were used in the simulator and the ergonometric and data and dimensions were integrated. With the use of this three dimensional measurement system, the adjustments necessary to provide comfort to different subjects were measured and pilot positions were analyzed so the variations in pilot attitude could be considered in the simulated pilot performance. Transl. by A.R.H.

N79-19630# National Aerospace Lab., Amsterdam (Netherlands).
AN ANALYSIS OF HELICOPTER PILOT CONTROL BEHAVIOR AND WORKLOAD DURING INSTRUMENT FLYING TASKS **c53**
J. Smit and Wewerinke *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

During helicopter instrument hover and navigation (tracking) tasks a number of flight data, physiological measures and subjective ratings were collected. Mathematical models were used to describe and analyze the pilot's control behavior and attention workload. The optimal control model seems to offer a suitable framework for the description of control tasks as complex as helicopter instrument flying. A control effort model, which was formulated in terms of the optimal control model, describes the relationship between performance and attention paid to the task. The physiological variables and subjective ratings in general reflected the variations in control effort connected with the various tasks. J.M.S.

N79-19631# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
DESIGN PROCEDURE FOR AN INFORMATION TRANSFER METHOD CUBITS FOR ALLOCATING PANEL AREA FOR AIRCREW STATION CONTROLS AND DISPLAYS **c05**
Patrick M. Curran *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 10 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

A systematic and objective method for the allocation of panel areas in aircrew workspaces was developed. The developed procedure is based on: (1) the criticality of the control or display on crew safety and mission effectiveness; (2) the frequency of utilization; and (3) the amount of information which is conveyed by the operator to the system through control actuation or which is conveyed to the operator by the display presentation. This procedure utilizes a computational method called CUBITS to establish a single figure of merit for the allocation of panel space. This method also deals with the number of control settings and accuracy required in the computation of the amount of information being transferred. J.M.S.

N79-19632# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
HUMAN FACTOR ENGINEERING TEST AND EVALUATION OF THE US NAVY LAMPS HELICOPTER SYSTEM **c54**
Patrick M. Curran, George J. Laurent, and Paul M. Linton *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 8 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The human factors engineering (HFE) planning, implementation, and contributions in the evaluation of the U.S. Navy Light Airborne Multi-purpose System (LAMPS) during calibrated range and open-sea operations are presented. Human factor engineering participation in this overall program was directed to the critical evaluation of the interfaces among the various system operators and their equipments in the two LAMPS system versions. The adequacy of the air and ship crews and their station designs in the two LAMPS system versions was assessed. The major sources of HFE data were subjective: operator questionnaire; structured observations; and tape-recorded interviews. Objective data included mission key-event printouts, internal communication system (ICS) voice tapes, and aircraft and shipboard display photographs. Conclusions are presented and discussed. J.M.S.

N79-19633# Centre d'Etudes et de Recherches, Toulon (France).
A DESCRIPTION OF THE RECENT NEUROPSYCHOLOGICAL SELECTION OF PILOTS FOR LAND FORCES LIGHT AIRCRAFT [DESCRITION DE LA NOUVELLE SELECTION NEUROPSYCHOLOGIQUES DES PILOTES DE L'AVIATION LEGERE DE L'ARMEEE DE TERRE] **c53**
E. J. Caille, D. Ziane (Aviation Legere de l'Armee de Terre, Villacoublay Air, France), A. Goavec (Antenne-Aviation Legere de L'Armee de Terre, Vincennes, France), and A. Elzear (Antenne-Aviation Legere de l'Armee de Terre, Vincennes, France) *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

Modern methods of automatic recording and analysis are used in an experimental battery of tests developed between 1974 and 1977 and validated on 200 operational helicopter pilots. The principal originality of the new selection process rests in the objective study of vulnerability manifested in the course of controlled situations (voluntary hypernea, intermittent luminous simulation, mental calculation, and muscular exercise) as manifested on EEG and EEC. The tracings are subjected to harmonic analysis and treated in real time on microprocessors. Classic cognitive tests, six psychometric questionnaires, and proof of piloting capability as demonstrated in a simulator are included in the pilot selection process. Transl. by A.R.H.

N79-19634# Hopital Begin, St. Mande (France).
RADIOLOGICAL EXAMINATION OF THE RACHIS AND FITNESS FOR EMPLOYMENT AS A HELICOPTER PILOT [EXAMEN RADIOLOGIQUE DU RACHIS ET APTITUDE AL'EMPLOI DE PILOTE D'HELICOPTERE] **c52**
R. P. Delahaye, Auffret, and P. J. Metges *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 3 p refs In FRENCH (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

Spinal pain in helicopter pilots is due partly to the pilot's

position and partly to vibrations generated by the aircraft. Clinical medicine shows that spinal pain has a variable intensity ranging from a simple annoyance to a painful ache. The chronic discomfort that evolves with or without pain during or after flight is caused by the pilot's position and is not experienced by airplane pilots. Both clinical and physiopathological evidence supports the arguments that a specific standard of aptitude should be applied in the selection of helicopter pilots. A common standard of aptitude cannot be developed for both combat aircraft and helicopter pilots because the lumbar rachis and the lumbo-sacral joint constitute the critical segment for the helicopter pilot, while the dorsal rachis and dorso-lumbar joint are the most critical in combat aircraft pilots following ejection. Transl. by A.R.H.

N79-19635# Royal Naval Air Medical School, Seafield Park (England).

A SYSTEM OF TRAINING IN AVIATION PHYSIOLOGY AND HUMAN FACTORS FOR ARMY AND NAVY HELICOPTER AIRCREW **c52**

P. S. Ormerod *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

Aeromedical training courses designed specifically for helicopter aircrews are described. Methods used to devise the present courses and the factors considered to be important in determining the usefulness of aeromedical training to aircrews are emphasized. J.M.S.

N79-19636# Textron Bell Helicopter, Ft. Worth, Tex. Human Factors and Cockpit Arrangement Group.

VISUAL REQUIREMENTS FOR THE HELICOPTER PILOT **c52**

William F. Lowe *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p ref (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

Flight test results of pilots flying obstacle avoidance maneuvers are discussed. Prediction that pilots would maneuver closer to obstacles on their side of the aircraft as opposed to obstacles on the copilot/observer side and that as speed of fly-by maneuvers increased the distance required for safe clearance would increase were not completely supported by the data. Explanation of these contradictory results are offered. A survey of commercial operators to determine the unique requirements of their operations is included along with a vision plot of a new commercial twin turbine helicopter. J.M.S.

N79-19637# Coast Guard, Alameda, Calif.

OBSERVATION OF NIGHT SHIPBOARD HELICOPTER OPERATIONS FROM A 210 FOOT US COAST GUARD CUTTER **c52**

W. W. Harvey, Jr. *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

Night helicopter operations were conducted to observe the effectiveness of flight deck lighting. These observations are outlined, and a simple review of visual perception is given. Emphasis is placed on improving safety aspects of night flight. J.M.S.

N79-19638# Army Aeromedical Research Unit, Fort Rucker, Ala.

OCULOMOTOR PERFORMANCE OF AVIATORS DURING AN AUTOROTATION MANEUVER IN A HELICOPTER SIMULATOR **c52**

Richard N. Armstrong, Gerald P. Krueger, John H. Sapp, and Yvonna F. Jones *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 14 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The oculomotor performance of ten US Army pilots, a group of five experienced and a group of five newly graduated aviators, was filmed during helicopter simulator flights conducted under precision instrument flight conditions. Each pilot flew a one hour precision instrument flight in a simulator on each of four days. On the fourth day, the flight scenario included a simulated engine failure that required the pilot to execute an autorotation maneuver. Oculomotor performance, pilot control, and aircraft flight dynamic measures were recorded during the fourth flight. The allocation of pilot visual activity to various instruments was observed to differ as a function of two phases of the autorotation maneuver. Pilots controlled rotor speed and airspeed closer to desired limits in the second phase than they did in the initial phase of the autorotation. Few differences of pilot visual activity were exhibited as a function of the experience level of the pilots. J.M.S.

N79-19639# Centre de Recherches de Medecine Aeronautique, Paris (France).

PROVIDING AN EYE SEPARATOR ON A COLOR CATHODE TUBE [POUVOIR SEPARATEUR DE L'OELL SUR TUBE CATHODIQUE COULEUR] **c52**

G. F. Santucci *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 10 p refs In FRENCH (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The visual acuity of simultaneously colored contrast on a radar video buffer television screen was studied using originally designed apparatus. Equal luminance was used during tests of the following colors: red, green, blue, purple, greenish-blue, yellow, and white. Tests conducted on 60 pilots between the ages of 20 and 50 resulted in the definition of the optimum proportion of character needed to assure recognition of form with good probability, as well as the precise contrast of color needed for rapid perception. The data thus obtained permits optimal reading of informtion on a cathode tube. Transl. by A.R.H.

N79-19640# Army Aeromedical Research Lab., Fort Rucker, Ala.

VISUAL PERFORMANCE/WORKLOAD OF HELICOPTER PILOTS DURING INSTRUMENT FLIGHT **c54**

R. R. Simmons, M. A. Lees, and K. A. Kimball *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 17 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

Visual and psychomotor performance data was collected in an attempt to investigate and study the general visual performance of aviators during IFR conditions. Two groups of aviators, with varied experience levels, were the subjects. A NAC Eye Mark Recorder and the Helicopter In-Flight Monitoring System were utilized to collect the required data. The results indicated, among other findings, that pilot subjective opinion does not agree with objective data. Additionally, the attitude indicator and radio compass comprised over 60 percent of the pilot's total visual workload, while the aircraft's status gauges were monitored less than 10 percent of the total time. These data should provide invaluable information concerning the visual requirements of pilots for safe helicopter operations. J.M.S.

N79-19641# Army Aeromedical Research Lab., Fort Rucker, Ala.

VISUAL POCKETS: A DESIGN PARAMETER FOR HELICOPTER INSTRUMENT PANELS **c05**

R. W. Bailey and David D. Glick *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 4 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The concept of fixation points between instruments ('Visual Pockets') for instrument flight of helicopters was proposed as a new concept to reduce pilot workload and improve performance. It was also proposed that this concept be applied to cockpit instrument panel design. In view of the significance attached to this revolutionary concept of 'Visual Pockets', a review and perspective of helicopter pilot visual information requirements are presented with special emphasis on the impact of 'Visual Pocket' concepts. J.M.S.

N79-19642# Federal Aviation Agency, Oklahoma City, Okla. Aviation Physiology Lab.

VISUAL AND OPTICAL ASSESSMENT OF GAS PROTECTIVE FACE MASKS **c54**

K. W. Welsh and J. A. Vaughan *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The visual characteristics of ophthalmic design requirements for smoke/gas protective face masks for pilots and aircrew members were studied. Visual tests with the mask in place indlude: (1) peripheral field of vision; (2) visual acuity; (3) stereoscopic depth perception; (4) color vision; and (5) spectacle frame displacement. Measurements were made on five adult males (age range 35 to 54 years) while wearing each of the 26 devices and again without the masks. Reduction in the temporal and inferior field was found with some of the goggle-mask (two-piece) combinations. These data indicate that 30.8 percent of the test items degraded visual acuity below 20/20 at the 0.4 m distance, 15.4 percent at 0.76 m, and 7.6 percent at 6.0 m. Mean values of depth perception ranged from 2.4 percent to 404.4 percent over control (no mask) values. The three goggles with tinted facepieces created no alterations in color perception. Spectacles worn with the two-piece protective masks were displaced upward on the face. Full-face (one-piece) masks displaced the spectacles downward. Suggested criteria for an acceptable protective mask are discussed. J.M.S.

N79-19643# Human Engineering Labs., Aberdeen Proving Ground, Md.

INTERNAL COCKPIT REFLECTIONS OF EXTERNAL POINT LIGHT SOURCES FOR THE MODEL YAH-64 ADVANCED ATTACK HELICOPTER c06

Christopher C. Smyth *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 16 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The US Army Human Engineering Laboratory (HEL) developed a computer program for computing the internal cockpit reflections on the transparent canopy surfaces of external point light sources. Computations were completed for the YAH-64 advanced attack helicopter (low glare canopy design). The results show that primary reflections as seen from the pilot's position are possible on: (1) the upper rear corners of the forward side canopy surfaces, (2) the upper edges of the rear sides, and (3) the sides of the top surface. Computations were also completed for the copilot's position and show possible reflections on the front and side surfaces. A computer graphics output is used to show reflection points on canopy layouts and perspectives of the cockpit. J.M.S.

N79-19644# Italian Air Force Medical Service H. Q., Rome.

SENSORIAL ASPECTS OF HELICOPTER OPERATIONS c54

Gaetano Rotondo *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 5 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The effects of sensorial phenomena related to the use of rotor-powered aircraft are examined, as components of physical and psychic workload in the piloting of helicopters, and therefore, as possible pathogenetic concurrent factors of operational fatigue in helicopter aircrews. Particularly, acoustic and nonacoustic vibrations are discussed with special reference to the effects exerted by vibratory motions on visual function. Another problem taken into consideration is the disorientation that the pilot may experience whenever there is a conflict between his own sensorial evaluations and the information supplied by the instruments. The means that might be employed for the purpose of ascertaining functional changes and possibly preventing negative effects produced by sensorial phenomena, are examined in order to attain a high degree of flight safety in helicopter operations as a result of the prevention of flight accidents due to the human factor. J.M.S.

N79-19645# Army Aeromedical Research Lab., Fort Rucker, Ala. Bioacoustics Div.

THE EFFECTIVE ACOUSTIC ENVIRONMENT OF HELICOPTER CREWMEN c54

Robert T. Camp, Jr. and Ben T. Mozo *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 2 p (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

Measurements taken to determine the acoustic environment of helicopter crewmen are discussed. It is indicated that the attenuation characteristics of helmets and hearing protectors and the variables of the physiology of the human ear as well as the acoustic hazards of voice communications systems, influence the overall acoustic environment of the flight personnel. J.M.S.

N79-19646# Army Avionics Research and Development Activity, Fort Monmouth, N. J.

A SURVEY OF COMMUNICATIONS IN THE HIGH NOISE ENVIRONMENT OF ARMY AIRCRAFT c32

Mitchell S. Mayer and Arthur W. Lindberg *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 18 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

In Army aircraft, the noise environment consists of a continuous noise level comprised of a mixture of random (broadband) and periodic frequencies (the aircraft noise signature or whine) and in the case of gunships, transient high-level noise bursts generated by the weapons systems. The noise environment reaching the aviator's ear is comprised of direct ambient noise penetration and communications systems processed noise (during periods of communications use, or open mike operations). The most insidious impact of the high noise levels is the long-term permanent hearing threshold shift, or hearing loss, that the aviator may incur from his prolonged exposure to the aircraft's interior sound pressure levels. Improvement of speech intelligibility under all flight conditions will improve the aviator's effectiveness by reducing the number of transmission repetitions necessary to assure that a message is correctly conveyed, thus reducing the distraction level during critical mission phases. Reducing the ambient aircraft noise processed by the communications system will further improve speech intelligibility and reduce this particular increased noise contribution to pilot stress. Author

N79-19647# Royal Aircraft Establishment, Farnborough (England). Human Engineering Div.

SOME ASPECTS OF HELICOPTER COMMUNICATIONS c32

G. M. Rood and E. J. Lovesey *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

Factors that influence helicopter radio communications are examined. These include: the characteristics of the signal transmitter and receivers and their siting; the effects of noise and distortion of the signals; and the ability of the operator to perceive the signals while performing other tasks. The interface of the man with the equipment and the helicopter environment and the effect of the helicopter environment upon his ability to receive and process audio signals is emphasized. Helicopter noise levels, helmet attenuation, signal masking, total operator noise dose, and crew task difficulty are considered in terms of improving the overall helicopter/crew efficiency. J.M.S.

N79-19648# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

DISORIENTATION IN ROYAL NAVAL HELICOPTER PILOTS c53

A. P. Steel-Perkins and D. A. Evans (Royal Naval Air Medical School, Hillhead, England) *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 5 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The incidence of pilot disorientation in fixed and rotary wing aircraft was investigated. Information regarding special orientation problems of naval helicopter pilots engaged in operations at sea and landing on moving platforms was obtained when a survey of 104 active USN pilots was reported. This questionnaire was adapted and distributed to Royal Navy helicopter pilots. The aims of the surveys were that useful information would be obtained on aircraft manning, cockpit and instrument design for future helicopter pilots regarding disorientation and thus a possible improvement in flight safety. J.M.S.

N79-19649# Army Aeromedical Research Lab., Fort Rucker, Ala.

OPERATIONAL CONSIDERATION OF AN/PVS-5 NIGHT VISION GOGGLES FOR HELICOPTER NIGHT FLIGHT c54

Wun C. Chiou *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p refs (For primary document see N79-19605

10-51)
Avail: NTIS HC A99/MF A01

Experimental results and operational problems are discussed in which artificial illumination is being utilized to increase helicopter night vision goggle (NVG) training duration when ambient illumination is insufficient. Two types of artificial illumination were evaluated. The first type utilizes the existing helicopter landing light as an illumination source. The second type uses auxiliary external illumination sources such as a searchlight. A modified one kilowatt AN/VSS-4 (XG-4) armored illuminator and the fire-fly lighting system were flight tested. Results reveal that the former provides a far better illumination pattern than the latter. Spectral transmission characteristics and optical quality of these artificial illumination sources are given in detail. Various advantages and disadvantages of using one kind versus the other will also be discussed in detail. It is shown that an artificial illumination source or a combination of various sources can be utilized to increase the helicopter NVG training time at night. J.M.S.

N79-19650# Army Aeromedical Research Lab., Fort Rucker, Ala.
TRAINING REQUIREMENTS FOR HELICOPTER OPERATION WITH NIGHT VISION GOGGLES **c54**
Isaac Behar, Dana M. Young, and James E. Johnson *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 4 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The Army Aviation Center experience in night vision goggle (NVG) stagefield training at night which identified numerous problem areas and their remediation are described. An evaluation of an approach to circumventing many of these problems as well as providing an added margin of safety by providing the initial part of the NVG training during the daytime using appropriate filters for the goggles is included. J.M.S.

N79-19651# Army Aeromedical Research Lab., Fort Rucker, Ala.
HEAD AIMING/TRACKING ACCURACY IN A HELICOPTER ENVIRONMENT **c54**
Robert W. Verona *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 18 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

This experiment was conducted to measure man's head aiming/tracking capability using a helmet mounted sighting device. The influences of target speed, helmet suspension types, sighting eye dominance, and helmet weighting parameters on head aiming/tracking were investigated. If the aiming/tracking accuracy was sensitive to manipulation of the man machine interface parameters, then it would seem to indicate that improved aiming/tracking accuracy could be obtained by improving the interface. The factors analyzed were: eye dominance, helmet weighting, target speed, and helmet suspension. The eye dominance and target speed factors were statistically significant. However, the only factor of practical significance was target speed. A subject aiming at a static target with his head has an RMS error of about 3.5 milliradians. If the target begins to move 4 deg/sec the error increases to about 10.5 milli-radians. When the subject begins to vibrate too, the error increases to 13 milliradians. If the target speed doubles as he is vibrating, the error increases to 16.8 milliradians. J.M.S.

N79-19652# Army Aeromedical Research Lab., Fort Rucker, Ala.
AVIATOR VISUAL PERFORMANCE: A COMPARATIVE STUDY OF A HELICOPTER SIMULATOR AND THE UH-1 HELICOPTER **c54**
R. R. Simmons, M. A. Lees, and K. A. Kimball *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 13 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The visual performance/workload of pilots during helicopter and simulated helicopter instrument flights was compared. The corneal reflection technique was utilized to obtain the visual data. Although pilot performance in the Army's UH-1FS simulator and the UH-1H helicopter were similar, several differences were noted. Additionally, the zone/cost factor theory was expanded. Pilots visual requirements for safe mission accomplishment was emphasized. J.M.S.

N79-19653# Michigan Univ., Ann Arbor. Inst. of Highway Safety Research.
OCCUPANT INJURY MECHANISMS IN CIVIL HELICOPTER ACCIDENTS **c03**
Richard G. Snyder *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 14 p refs Sponsored in part by FAA and NTSB (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

Mechanisms incurred in several selected accidents involving roll-over, rotor blade strike, and seat and restraint system failures are discussed. The present injury and fatality rate could be reduced in civil accidents by improved restraints, including use of upper-torso belts, energy-absorbing seats, crashworthy fuel systems, and increased use of protective helmets. J.M.S.

N79-19654# Army Agency for Aviation Safety, Fort Rucker, Ala.
COMPARATIVE INJURY PATTERNS IN US ARMY HELICOPTERS **c03**
Laurel D. Sand *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The type of injuries, body area injured, and cause of injuries to 740 U.S. Army aviators involved in 388 rotary wing accidents from 1 January 1972 through 30 September 1977 are examined. Considerations are given to two main areas: (1) relationship to injury regarding the aviator's height, weight, and location aboard the aircraft, cockpit condition, and aircraft altitude; and (2) comparison of present injury experience with previous injury studies. The results, through statistical analyses, show that not one, or even combinations, of those factors listed were significant in injury causation. Further, comparisons of injuries show that the overall injury pattern has not changed significantly in the past 20 years. For example, injuries to the extremities, the head, and the spine continue to be among the leading body areas to be injured. Also, 94 percent of all accidents from 1957 to the present were classified as survivable but produced 33 percent of all fatalities. J.M.S.

N79-19655# Army Agency for Aviation Safety, Fort Rucker, Ala.
ENGINEERING ANALYSIS OF CRASH INJURY IN ARMY AIRCRAFT **c03**
James E. Hicks *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

A methodology for identification of crashworthiness deficiencies in Army aircraft is discussed. The methodology provides for injury and impact data to be extracted from accident reports using a specially developed injury coding system. Personnel injuries are costed through a technique which provides for consideration of each injury based on its relative severity as determined by medical examination. Crash injury causes are identified and ranked according to the magnitude of their effect and probability of occurrence. The technique is designed to provide recommendations as to the most urgent crashworthiness research/development/procurement efforts for consideration by aircraft systems managers and aviation research laboratories. An application of the methodology to an operated Army aircraft is shown. Preliminary results as to the more significant crash hazards in this aircraft are discussed. Recommendations are made as to the use of the methodology and to additional investigation aids which would improve the future identifications of crash hazards. J.M.S.

N79-19656# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).
VERTEBRAL PAINS IN HELICOPTER PILOTS [LES ALGIES VERTEBRALES DES PILOTES D'HELICOPTERES] **c52**
R. Auffret, R. P. Delahaye, P. J. Metges, and Vicens *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p In FRENCH (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

Despite progress in aeronautical technology, pathological conditions of the rachis caused by piloting helicopters still persists. On the functional level, lumbar pain is the main constituents of the chronic condition and is often compounded by shooting pains, sometimes associated with sciatica, whose delayed appearance is, without doubt, caused by flight rhythms. Radiology reveals the presence of arthrosis signs and, on occasion, a congenital anomaly. In 30 percent of the cases studied, radiology is normal. Dorsal pain exists in about 50 percent of the cases with discrete signs of arthrosis in the 8th, 9th, and 10th vertebrae. Clinical evidence of this is practically nonexistent in the population studied. In all of the pilots examined a type of arthrosis is revealed in the 5th, 6th, and 7th cervical vertebrae, often associated with cervical rectitude in the sagital plane. These dorsal and cervical radiological anomalies appear with great frequency in relatively young subjects. Transl. by A.R.H.

N79-19657# Army Agency for Aviation Safety, Fort Rucker, Ala.

ASSESSMENT OF THE BENEFITS OF AIRCRAFT CRASHWORTHINESS **c05**

Andrew E. Gilewicz *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 8 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

An assessment is made of the economic benefits of providing crashworthiness improvements within future Army helicopters. Crashworthiness features which would be most worthwhile in preventing or reducing injury and hardware damage are discussed from a cost effectiveness standpoint. Predictions of future accident losses for a number of candidate utility helicopter replacements are given. Projections were derived based on each helicopter's crashworthiness design features and the effectiveness in injury and hardware damage prevention. The technical adequacy of the design requirements is verified based on typical Army helicopter crash impacts. J.M.S.

N79-19658# Army Aviation Research and Development Command, Fort Eustis, Va. Applied Technology Lab.

CRASHWORTHY HELICOPTER SEATS AND OCCUPANT RESTRAINT SYSTEMS **c03**

George T. Singley, III and Stanley P. DesJardins (Simula, Inc., Tempe, Ariz.) *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 32 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

Seats and restraint systems offering substantial improvements in comparison to existing helicopters with respect to strength, body restraint, and crash force attenuation are described. These seat and restraint systems are capable of retaining the seated occupant in the same relative position within the aircraft throughout the 95th percentile potentially survivable accident without the occupant being subjected to conditions in excess of human tolerance. Cockpit and cabin seat and restraint systems retention strengths are shown to withstand drop and sled tests with velocity changes of 50 ft/sec and peak accelerations of 48G for drop tests and 30G for sled tests. This increased strength is achieved with lightweight designs and is made possible by the application of load limiting principles. This crash force attenuation characteristic limits the impact loading not only of the seat structure but also of the seat occupant. J.M.S.

N79-19659# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

SOME IMPROVEMENTS TO THE UK HELICOPTER COCKPIT **c05**

D. C. Reader *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 3 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The human-factor aspects of helicopters are discussed. These include: improvements to the restraint harnesses; the location and methods of stowage of the survival aids; and the strength, adjustment and anti-vibration properties of the crew seats. Experiments conducted to investigate the feasibility of different configurations of flight control are described. J.M.S.

N79-19660# Army Aeromedical Research Lab., Fort Rucker, Ala.

HELICOPTER CRASHWORTHY FUEL SYSTEMS AND THEIR EFFECTIVENESS IN PREVENTING THERMAL INJURY **c05**

Stanley C. Knapp, Pierre Allemond (Army Agency for Aviation Safety, Ft. Rucker, Ala.), and David H. Karney *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

All Army helicopter accidents during the period 1968-1976 are reviewed and classified by survivability and whether or not the aircraft was equipped with a crashworthy fuel system. Accident associated fatalities and injuries are reclassified as to the primary injury involved and its relationship to the existence of any postcrash fire. The direct costs involved in the care of thermal fatalities and thermal injuries are calculated using the most conservative estimates. It is shown that the helicopter crashworthy fuel system essentially eliminated postcrash fatalities and injuries in accidents involving helicopters equipped with the new system. J.M.S.

N79-19661# Arizona State Univ., Tempe. Engineering Safety Center.

A METHOD FOR SELECTING A CRASHWORTHY FUEL SYSTEM DESIGN **c05**

S. Harry Robertson and James W. Thurbow *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

A rating method that a crashworthy fuel system designer can use to help determine the amount of hardware and special design considerations needed to obtain a desired reduction in the fuel system fire hazard level is discussed. Man's tolerance to the thermal environment, and the escape time available to the aircraft occupants are among the factors considered. J.M.S.

N79-19662# Louisiana State Univ., Shreveport. School of Medicine.

BIOMEDICAL CONSTRAINTS ON THERMAL PROTECTIVE FLIGHT CLOTHING DESIGN: A BIOENGINEERING ANALYSIS **c54**

Francis S. Knox, III, Thomas L. Wachtel (California Univ., San Diego), and Stanley C. Knapp (Army Aeromedical Research Lab., Ft. Rucker, Ala.) *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

From studies of the dynamics of large JP-4 fuel fires and of instrumented helicopter hulks immersed in such fires, the worst credible postcrash fire environment was defined. Data from these fires allowed the the construction and calibration of a JP-4 fueled postcrash fire simulator. This simulator was used to expose 95 domestic white pigs (animal for human skin) to simulated postcrash fires of various intensities and various durations. In some instances fabrics (e.g., Nomex) were placed between the fire and the pig. The resultant burns were graded on surface appearance and on depth of damage. The relationship between thermal energy and burn depth is complex and depends on, among other things, initial skin temperature, skin color, length of hair stubble, exposure time, and amount and rate of tissue water boiling. Fabrics tend to lower the amount of energy transmitted to the skin provided they remain intact and maintain an insulating air layer. The experimental burn data presented and survival data from the Natural Burn Information Exchange form the basis of a rational consideration of the biomedical constraints on thermal protective flight clothing design when compared with textile engineering and cost factors. J.M.S.

N79-19663# Sikorsky Aircraft, Stratford, Conn. Systems Engineering Branch.

CRASH SURVIVABILITY OF THE UH-60A HELICOPTER **c05**

Brian L. Carnell *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 10 p (For primary document see N79-19605 10-51)

Avail: NTIS HC A99/MF A01

The Sikorsky UH-60A or BLACK HAWK is designed to

minimize the hazards found in the many accidents that occurred in the combat environment of Southeast Asia. Its crash survivability design features are discussed. These include: (1) a protective shell is maintained around the occupants; the energy absorbing landing gear cushions the crash impact and the structure is designed to minimize penetration by rotor blades, transmissions and engines; (2) the loads on the occupants are limited to noninjurious levels; all seats are energy attenuating; (3) major postcrash fires are prevented; a complete crash survivable fuel system is installed; (4) the interior is noninjurious; no hard structure is in the head strike zones. Padding and shielding in the cockpit protect the aircrew from injury and entrapment; and (5) adequate emergency escape capability is provided; jettisonable cockpit doors and cabin windows allow rapid emergency egress. J.M.S.

N79-19664# Hughes Helicopters, Culver City, Calif. Structural Analysis Section.
THE APPROACH TO CREW PROTECTION IN THE CRASH ENVIRONMENT FOR THE YAH-64 **c03**
John M. McDermott *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

The approach to crashworthiness in protecting the crew of the advanced attack helicopter is described. Basic requirements of crash criteria specified by the Army are presented. Impact modes and impact velocities are discussed. The means used to meet these requirements using a total systems approach (i.e., landing gear, plus fuselage crushing and energy absorbing seats all in series) are presented. Crash pulses felt by the occupants during the various crash impacts are presented. Design of energy absorbing seats is discussed. Protection of the crew by use of turnover structure and by means of high load factors on heavy mass items which could penetrate the cockpit is illustrated. Maintaining living space during crash barrier impacts, and protection against blade strikes using the roll over structure are discussed. J.M.S.

N79-19665# Naval Training Equipment Center, Orlando, Fla.
HELICOPTER UNDERWATER ESCAPE TRAINER (9D5) **c09**
William F. Cunningham *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 3 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

A helicopter equivalent of the Navy Dilbert Dunker long used as an underwater escape procedures trainer is described. The same principles of of the Dilbert Dunker apply to the helicopter escape trainer. Aircrews ride the trainer from different seat positions, thoroughly gaining confidence in their ability to successfully escape from anywhere in the helicopter. This training reflects the belief that successful escape from a ditched/sinking helicopter depends largely on spontaneous action achieved through repetitive drills. The results tend to prove this true. J.M.S.

N79-19666# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
BAILOUT FROM AUTOROTATING HELICOPTERS **c03**
H. D. Melzig, U. Schmidt, and E. A. Bockemuller *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

Parachute jumps were conducted from an autorotating helicopter to prove the possibility of bailout with a parachute as a means of rescue in emergency cases. The tests were conducted at glide angles of 17 deg proving by their good agreement with the computed results the general applicability of the computational method to glide angles up to 90 deg. The results show that bailout from autorotating helicopters is possible for all glide angles. It is recommended, however, that crew members are taught to perform the ball attitude and give a delay of 3 sec before releasing their parachute. J.M.S.

N79-19667# Mississippi State Univ., Mississippi State. Dept. of Botany.
DISTRIBUTION OF BLUEGREEN ALGAE IN A MISSISSIPPI GULF COAST SALT MARSH M.S. Thesis
William W. Sage May 1978 55 p refs
(Contract DI-14-34-0001-7052)
(PB-288982/2; W79-01356; OWRT-A-099-MISS(2)) Avail: NTIS HC A04/MF A01 CSCL 08A

Samples of edaphic bluegreen algal communities were selected from five monotypic angiosperm zones in Graveline Bay Marsh near Ocean Springs, Mississippi, and later evaluated in the laboratory to determine the species distribution and relative abundance. Results showed that communities in all five zones of the marsh were dominated by Schizothrix calcicola (Ag.) Gom. throughout the year and subdominants varied seasonally. In all zones, the number of individuals was greatest in the summer and lowest in winter. Examining structure of the five edaphic communities indicated a single, nearly homogeneous community exists over the entire marsh surface which is shaded by an angiosperm canopy. Light intensity appears to be the major factor affecting distribution. GRA

N79-19668# North Carolina State Univ., Raleigh. Dept. of Zoology.
BACTERIA IN A NORTH CAROLINA SALT MARSH. STANDING CROP AND IMPORTANCE IN THE DECOMPOSITION OF SPARTINA ALTERNIFLORA
Parke A. Rublee, Leon M. Cammen, and John E. Hobbie Aug. 1978 89 p refs
(Grant NOAA-04-6-158-44054)
(PB-288816/2; UNC-SG-78-11; NOAA-78102607) Avail: NTIS HC A05/MF A01 CSCL 06M

The number of bacteria in sediments of a North Carolina salt marsh was determined by direct counts with epifluorescent illumination and acridine orange stain. The number and size of bacteria at four depths in the marsh were monitored by direct counts for thirteen months. Mean yearly estimates for standing crop indicated that bacteria contribute about 36% of the microbial carbon in surface sediments by only 0.6% of total organic carbon and about 1.5% of total nitrogen. Bacteria are the major constituent of total microbial carbon at depth in the sediment. GRA

N79-19021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF HYPODYNAMIC SIMULATIONS ON THE SKELETAL SYSTEM OF MONKEYS
D. R. Young and J. W. Tremor *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 123-140 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 06C

N79-19022*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIRCRAFT FLIGHT SIMULATION OF SPACELAB EXPERIMENT USING AN IMPLANTED TELEMETRY SYSTEM TO OBTAIN CARDIOVASCULAR DATA FROM THE MONKEY
E. P. McCutcheon, R. Miranda, T. B. Fryer, G. Hodges, B. D. Newson, and N. Pace *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 141-153 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 06B

N79-19025*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE EFFECT OF 1 TO 5 keV ELECTRONS ON THE REPRODUCTIVE INTEGRITY OF MICROORGANISMS
J. Barengoltz and J. Brady (Bionetics Corp.) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 179-188 refs (For primary document see N79-19013 10-12)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 06C

N79-19026*# Stillman Coll., Tuscaloosa, Ala.
DEVELOPMENTAL AND HEMATOLOGICAL RESPONSES TO LOW LEVEL CONTINUOUS EXPOSURE OF NITROGEN DIOXIDE IN MICE
Jarnail Singh *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 189-196 refs (For primary document see N79-19013 10-12)
(Grant NIH-MBS-08021)
Avail: NTIS HC A20/MF A01 CSCL 06C

N79-19027*# Stillman Coll., Tuscaloosa, Ala.
ELECTROPHORESIS PATTERN OF SERUM FROM MICE

EXPOSED TO DIFFERENT CONCENTRATIONS OF SULFUR DIOXIDE
Jarnail Singh *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 197-200 refs (For primary document see N79-19013 10-12)
(Grant NIH-MBS-08021)
Avail: NTIS HC A20/MF A01 CSCL 06C

N79-19028*# Stillman Coll., Tuscaloosa, Ala.
THE EFFECTS OF THE POLLUTANT, SODIUM CYANIDE, ON THE MORPHOLOGY AND PHYSIOLOGY OF OEDOGONIUM CARDIACUM
Elbert Sparks *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 201-209 refs (For primary document see N79-19013 10-12)
(Grant RR0802104)
Avail: NTIS HC A20/MF A01 CSCL 06C

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-19669* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 190, FEBRUARY 1979
Feb. 1979 82 p
(NASA-SP-7011(190)) Avail: NTIS HC E03 CSCL 06E

This bibliography lists 235 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1979. Author

N79-19670 Stanford Univ., Calif.
HUMAN CIRCADIAN PHYSIOLOGY: INTERNAL ORGANIZATION OF TEMPERATURE, SLEEP-WAKE AND NEUROENDOCRINE RHYTHMS MONITORED IN AN ENVIRONMENT FREE OF TIME CUES Ph.D. Thesis
Charles Andrew Czeisler 1978 376 p
Avail: Univ. Microfilms Order No. 7905838

The purpose of this experiment was to study several variables which express rhythmicity in man and which also play a very important role in human physiology, in order to gain a better understanding of the interaction and interrelationships between these functions under a variety of environmental conditions. Multiple circadian rhythms were monitored in 11 human subjects living in an environment free of time cues for a period of two weeks to 3.5 months. Repetitive measurements of sleep stages, core and skin temperatures, plasma cortisol and somatotropin were carried out under entrained, free running and reentrained conditions. All eleven subjects developed free running sleep-wake rhythms greater than 24 hours, but with considerable variability in the mean period lengths and individual sleep segments. Dissert. Abstr.

N79-19671 Purdue Univ., Lafayette, Ind.
THE RELATIONSHIP BETWEEN ADULT ARTICULAR CARTILAGE THICKNESS AND DYNAMIC LOADS OF A UNIAXIAL JOINT Ph.D. Thesis
Gerald James Pijanowski 1978 76 p
Avail: Univ. Microfilms Order No. 7905763

The uniaxial equine metacarpophalangeal joint was chosen as an appropriate model for study of this relationship. The contact areas for three positions of dorsiflexion (160 deg, 140 deg, 125 deg as measured on the extensor surface) were determined using a spatial linkage system and associated computer programs for nine joints from five adult ponies. These positions corresponded to joint loads sustained during the support (weight-bearing) phase of the walk and trot of 0.0 to 0.5 times body weight, 2.0 to 2.5 times body weight and 4.5 to 5.0 times body weight, respectively. The thickness of the uncalcified articular cartilage was measured microscopically at a number of defined points on the distal articular surface of the third metacarpal bone and the proximal articular surface of the first phalanx. The thickness of cartilage in contact was defined as the mean of the thickness of all points within the contact area. Dissert. Abstr.

N79-19672 Stanford Univ., Calif.
ESTIMATION OF NERVE-BUNDLE CONDUCTION Ph.D. Thesis
Kenneth Laurence Cummins 1978 124 p
Avail: Univ. Microfilms Order No. 7905837

A model is presented describing the nerve-bundle compound action potential (CAP) in terms of its constituent single fiber action potentials (SFAPs). The model has a general structure capable of accommodating a large variety of specific assumptions regarding the nature of the CAP. Using this model, two techniques are developed for estimating the distribution of nerve-fiber conduction velocities (CVs) in a nerve bundle. Both techniques require only noninvasive electrophysiological measurements similar to those currently in wide clinical use. When SFAP characteristics are known, a single CAP is analyzed utilizing a minimum sum-squared-error criterion for solving over-specified systems of linear equations to yield an estimate of the fiber CV distribution. The model in its most general form may be used with this method. Dissert. Abstr.

N79-19673 Purdue Univ., Lafayette, Ind.
A MATHEMATICAL SCHEME FOR PREDICTING THE ELECTRO-ACOUSTIC FREQUENCY RESPONSE OF HEARING AID RECEIVER-EARMOLD-EAR SYSTEMS Ph.D. Thesis
David Post Egolf 1976 203 p
Avail: Univ. Microfilms Order No. 7905685

As a preliminary step to attaining the desired goal, mathematical techniques were developed for analyzing the dynamics of earmold-sized acoustic transmission tubes and hearing aid receivers. The results are then incorporated into a digital computer program designed to predict sound pressure level data in real and artificial ears fitted with any receiver-earmold combination. The scheme is successfully tested on an actual receiver-earmold-artificial ear system. Universal application of the method is also demonstrated by successfully testing it on several different receiver-earmold-ear combinations, using both real and artificial ears. The same method is then used to predict electroacoustic frequency response data which is characteristic of a number of commonly-encountered cases. These include two cases of real ear pathology and numerous variations of earmold internal geometry. Dissert. Abstr.

N79-19674 Johns Hopkins Univ., Baltimore, Md.
A STUDY OF SOME OF THE FACTORS INFLUENCING THE LEFT VENTRICULAR DIASTOLIC PRESSURE-VOLUME RELATIONSHIP AND MYOCARDIAL METABOLISM Ph.D. Thesis
Douglas Francis Munch 1979 221 p
Avail: Univ. Microfilms Order No. 7906416

The effect of some of the factors which might contribute to left ventricular stiffness, such as coronary perfusion pressure or flow rate, contractility, chronotropic state, and vascular tone are examined. Also, the metabolism of isovolumic ventricular contractions is studied using a new method. A carefully designed preparation allowed close control of coronary perfusion, heart rate, ventricular volume, and inotropic state. Diastolic pressure-volume relationships were studied in isolated blood-perfused dog hearts, by stepwise changes in left ventricular balloon volume. Coronary blood flow or coronary perfusion pressure control is described. Dissert. Abstr.

N79-19675 Marquette Univ., Milwaukee, Wis.
NONINVASIVE TECHNIQUES IN THE EVALUATION OF THE PERIPHERAL CIRCULATION Ph.D. Thesis
Sergio Xavier De Salles-Cunha 1978 406 p
Avail: Univ. Microfilms Order No. 7905171

Present noninvasive techniques are compared and analyzed. The results of Doppler ultrasound and impedance methods for detection of venous thrombosis, and Doppler ultrasound for internal carotid disease are compared with angiography. Procedures for quantitative blood flow measurements in clinical applications using nuclear magnetic resonance and transcutaneous electromagnetic flowmetry (TEMF) are developed. Overviews of vascular diseases, safety of noninvasive techniques and

topics of circulatory physiopathology are given. A mathematical model is developed to calculate flow through a limb or neck segment using TEMF. An analytical solution is presented for cylindrical concentric-vessel model having three-media (tissue-vessel-blood). A conformal transformation adapts this solution to the boundary conditions of an eccentric vessel model. The principle of superposition solves the problem of several vessels. Dissert. Abstr.

N79-19676 Iowa State Univ. of Science and Technology, Ames.
MECHANICS OF BLOOD FLOW THROUGH NORMAL AND STENOTIC CORONARY ARTERIES Ph.D. Thesis
Richard Lloyd Kirkeeide 1978 187 p
Avail: Univ. Microfilms Order No. 7903988

The mechanics of blood flow through normal and stenotic coronary arteries was investigated by means of a series of in vivo experiments involving the canine left circumflex coronary artery, used in conjunction with a semi-empirical, quasi steady-flow model of the myocardial vascular bed. In addition to recorded coronary flow and aortic and left ventricular pressures, the total intravascular resistance of the myocardial vascular bed was evaluated. The model was based upon the vascular waterfall concept of flow through collapsible tubes and allowed for predictions of dynamic coronary flow and regional distributions of intramyocardial tissue pressure, myocardial intravascular resistance and myocardial blood flow. Dissert. Abstr.

N79-19677*# General Electric Co., Houston, Tex. Space Div.
REGIONAL PROGRAM FOR ACQUISITION OF MEDICAL EXPERIMENTS Final Report
P. C. VanNordstrand 31 Oct. 1978 18 p
(Contract NAS9-15462)
(NASA-CR-160121; TIR740-RP-7006) Avail: NTIS HC A02/MF A01 CSCL 06B

A U.S. company was contracted to covering different regions of the country. A moderately detailed description of the highlights of the company activities along with some conclusions and recommendations are reported. In summary, the regional program effectively: (1) informed segments of the medical community of research opportunities; (2) validated formats for regional workshops; (3) assisted potential investigators with follow-up consultations and proposal preparations; and (4) identified a latent intersect requiring continual dialog at the scientist/engineer interface for successful cultivation and integration. G.Y.

N79-19678*# National Aeronautics and Space Administration. Pasadena Office, Calif.
APPARATUS FOR ENDOSCOPIC EXAMINATION Patent Application
Robert E. Frazer, inventor (to NASA) (JPL) 17 Jun. 1977 20 p Sponsored by NASA
(NASA-Case-NPO-14092-1; US-Patent-Appl-SN-807597) Avail: NTIS HC A02/MF A01 CSCL 06B

An endoscope is disclosed having a propulsion mechanism and at least one transmitter at the distal end transmitting bursts of energy waves (radio frequency or ultrasonic) for tracking the postiion of the distal end through the use of two or more transducers on the anterior or lateral surfaces of a patient. The propulsion mechanism may consist of two radially expandable bladders separated by an axially expandable bellows with only the forward bladder attached to the distal end so that by expanding and contracting them in proper sequence, propulsion of the endoscope is achieved. Alternate mechanisms comprise compliant paddles on the distal end directly on an articulated section, or compliant paddles on a rotatable sleeve on the distal end. The edoscope has a sheath which includes material having a sharp melting point slightly above body temperature so that the sheath may be made flexible at selected sections by applying current to separate heating wires in the sections of the sheath. NASA

N79-19679# Army Research Inst. of Environmental Medicine, Natick, Mass.
A COMPARISON OF THE PHYSIOLOGICAL RESPONSES IN YOUNG MEN AND WOMEN TO HEAT AND COLD STRESS
6 Oct. 1978 39 p refs
(DA Proj. 3E7-62777-A-845)
(AD-A061024; USARIEM-M-1/79) Avail: NTIS HC A04/MF A01 CSCL 06/19

The current literature on male-female differences in response to thermal stress was reviewed. Morphological differences of women (20% smaller body mass, 14% more body fat, 33% less lean body mass, but only 14-22% less surface area) impinge greatly on their relative ability to balance body heat production and losses. Women have greater body insulation against thermal transients when fully vasoconstricted (except on hands and feet) and a greater peripheral body 'shell' for a heat sink, but at the cost of (1) a greater burden of body fat to be transported, (2) less muscle mass and strength, and (3) a disproportionately smaller circulating blood volume. Women have lower blood hemoglobin concentrations, which necessitates higher cardiac output from their smaller hearts for equivalent muscular work, resulting in higher heart rates. In the heat, they generally show (1) relatively more peripheral blood pooling when vasodilated, (2) a greater increase in heart rate, (3) a greater tendency for circulatory embarrassment, (4) lower maximal sweat rates, (5) higher skin temperatures with greater body heat storage, (6) lesser ability to maintain circulating blood volume, and (7) greater effects from dehydration. Because of these differences, it is even more essential for women than men that they be given adequate time for adaptation to thermal stress and, where possible, be provided appropriate environmental protection. GRA

N79-19680# Dayton Univ. Research Inst., Ohio.
A REAL-WORLD ASSESSMENT OF NOISE EXPOSURE Final Report, 4 Nov. 1974 - 4 Nov. 1977
Thomas R. Schori and Edward A. McGatha Aug. 1978 57 p refs
(Contract F33615-75-C-5055)
(AD-A061692; UDR-TR-77-63; AMRL-TR-77-96) Avail: NTIS HC A04/MF A01 CSCL 06/19

The noise exposure of 50 individuals was continuously monitored for 7 consecutive days, by means of personal noise dosimeters. Over the 7 days of the test average Leq(24)'s (or what could be termed Leq(week)'s) among these individuals ranged from a low of 66 db to a high of 85 db, with a median of 74.7 db. Over 80 percent of the individuals had average Leq(24)'s greater than the minimum level of 70 db identified by the Environmental Protection Agency to protect public health and welfare with an adequate margin of safety (EPA 1974). Yet, with one exception, all of these individuals had average Leq(24)'s that were less than the minimum that would be exhibited by a worker who, during the working week, was exposed to the maximum level permissible under OSHA's current noise exposure regulation. Surprisingly enough, the highest average Leq(24) was not exhibited by a worker, but was exhibited by a 13 year old school boy. Author (GRA)

N79-19681# Army Research Inst. of Environmental Medicine, Natick, Mass.
INSTRUMENTATION AND TECHNIQUES FOR THE MEASUREMENT OF MUSCULAR STRENGTH AND ENDURANCE IN THE HUMAN BODY
Marcos U. Ramos and Joseph Knapik 22 Mar. 1978 29 p refs
(AD-A061023; USARIEM-M-17/78) Avail: NTIS HC A03/MF A01 CSCL 06/16

Apparatus and procedures for the measurement of isokinetic, isometric and isotonic strength of the knee and elbow extensors and flexors, plantar flexors and hand grip muscles of the intact human body is presented. Special attention is given to immobilization of the proximal body segments and the biomechanical characteristics of joint and muscle groups being measured. Estimates of the reliability of the apparatus and procedure was found to be high indicating good ability to discriminate muscle strength among subjects on the selected muscle groups. Author (GRA)

N79-18945# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
APPLICATION OF NUMERICAL METHODS TO PHYSIOLOGICAL FLOWS
Thomas J. Mueller *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1976 95 p refs Sponsored in part by Am. Heart Assoc. and NSF (For primary document see N79-18943 10-02)
Avail: NTIS HC A19/MF A01

N79-19020*# Jackman (K. R.), La Jolla, Calif.
TELEMEDICINE: AN EXPANDING NEW SCIENCE ON LAND AND SEA
K. R. Jackman and Anthony J. Rippo (Marine Med. Serv., Inc., San Diego, Calif.) *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 105-121 refs (For primary document see N79-19013 10-12)
Avail: NTIS HC A20/MF A01 CSCL 06E

N79-19609# German Air Force, Porz-Wahn (West Germany). Helicopter Transportation Wing.
NIGHT RESCUE OPERATION PROCEDURE OVER SEA WITH BELL UH-1D HELICOPTERS
Heinz Knoche *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 8 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19618# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
PROTECTIVE APPROACHES IN THE MODERATION OF THE PHYSIOLOGICAL EFFECTS OF EXTREME AMBIENT CONDITIONS IN HELICOPTER OPERATIONS
Louis J. SantaMaria *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19619# Army Aeromedical Research Lab., Fort Rucker, Ala.
IN-FLIGHT TOXICOLOGY OF FIXED AND ROTARY WING AIRCRAFT CREW STATIONS
Gary D. Pollard and Doris W. Hirsch *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19620# German Air Force, Porz-Wahn (West Germany). Helicopter Transportation Wing.
BACKACHE IN UH-1D HELICOPTER CREWS
H. C. Schulte-Wintrop (LTK, Munster, W. Ger.) and H. Knoche *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 12 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19622# Advisory Group for Aerospace Research and Development, Paris (France). Aerospace Medical Panel.
EVALUATION OF AIRCREW FATIGUE DURING OPERATIONAL HELICOPTER FLIGHT MISSION
C. Koch (Italian Air Force, Rome) and F. Monesi *In its* Operational Helicopter Aviation Med. Dec. 1978 2 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19624# Wood (William C.), Memphis, Tenn.
IMPLEMENTATION OF A DIVISIONAL AVIATION PROGRAM TO DECREASE FLIGHT CREW FATIGUE
William C. Wood *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19634# Hopital Begin, St. Mande (France).
RADIOLOGICAL EXAMINATION OF THE RACHIS AND FITNESS FOR EMPLOYMENT AS A HELICOPTER PILOT [EXAMEN RADIOLOGIQUE DU RACHIS ET APTITUDE AL'EMPLOI DE PILOTE D'HELICOPTERE]
R. P. Delahaye, Auffret, and P. J. Metges *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 3 p refs In FRENCH (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19635# Royal Naval Air Medical School, Seafield Park (England).
A SYSTEM OF TRAINING IN AVIATION PHYSIOLOGY AND HUMAN FACTORS FOR ARMY AND NAVY HELICOPTER AIRCREW
P. S. Ormerod *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19636# Textron Bell Helicopter, Ft. Worth, Tex. Human Factors and Cockpit Arrangement Group.
VISUAL REQUIREMENTS FOR THE HELICOPTER PILOT
William F. Lowe *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p ref (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19637# Coast Guard, Alameda, Calif.
OBSERVATION OF NIGHT SHIPBOARD HELICOPTER OPERATIONS FROM A 210 FOOT US COAST GUARD CUTTER
W. W. Harvey, Jr. *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19638# Army Aeromedical Research Unit, Fort Rucker, Ala.
OCULOMOTOR PERFORMANCE OF AVIATORS DURING AN AUTOROTATION MANEUVER IN A HELICOPTER SIMULATOR
Richard N. Armstrong, Gerald P. Krueger, John H. Sapp, and Yvonna F. Jones *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 14 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19639# Centre de Recherches de Medecine Aeronautique, Paris (France).
PROVIDING AN EYE SEPARATOR ON A COLOR CATHODE TUBE [POUVOIR SEPARATEUR DE L'OELL SUR TUBE CATHODIQUE COULEUR]
G. F. Santucci *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 10 p refs In FRENCH (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19656# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).
VERTEBRAL PAINS IN HELICOPTER PILOTS [LES ALGIES VERTEBRALES DES PILOTES D'HELICOPTERES]
R. Auffret, R. P. Delahaye, P. J. Metges, and Vicens *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p In FRENCH (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19985# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF HUMAN ADAPTION TO SPACEFLIGHT
O. G. Gazenko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 61 (JPRS-72988) 13 Mar. 1979 p 23-30 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 1, 1979 p 17-21 (For primary document see N79-19983 10-99)
Copyright. Avail: NTIS HC A04/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-19682*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRLINE PILOT SCAN PATTERNS DURING SIMULATED ILS APPROACHES
Amos A. Spady, Jr. Oct. 1978 72 p refs
(NASA-TP-1250; L-11989) Avail: NTIS HC A04/MF A01 CSCL 05J

A series of instrument landing system approaches were conducted using seven airline-rated Boeing 737 pilots in a Federal

Aviation Administration qualified simulator. The test matrix included both manual and coupled approaches with and without atmospheric turbulence in Category II visibility conditions. A nonintrusive oculometer system was used to track the pilot eye-point-of-regard throughout the approach. The results indicate that, in general, the pilots use different scan techniques for the manual and coupled conditions and that the introduction of atmospheric turbulence does not greatly affect the scan behavior in either case. The pilots consistently ranked the instruments in terms of most used to least used. The ranking obtained from the oculometer data agrees with the pilot ranking for the flight director and airspeed, the most important instruments. However, the pilots apparently ranked the other instruments in terms of their concern for information rather than according to their actual scanning behavior. L.S.

N79-19683# Validated instruction Associates, Inc., Albion, Mich.
MASCULINITY, FEMININITY, ANDROGYNY. WHAT REALLY WORKS AT WORK Interim Technical Report, 1 Feb. - 30 Sep. 1978
Kirsten Hinsdale and J. David Johnson Sep. 1978 39 p refs (Contract N00014-77-C-0625)
(AD-A061177; ITR-2) Avail: NTIS HC A03/MF A01 CSCL 05/10

To investigate the relative adaptiveness of masculinity, femininity, and androgyny in the workplace, 63 Navy personnel detailers were asked to rate the success, adjustment, and attainment they predicted for six hypothetical Navy recruits, including feminine, masculine, and androgynous recruits of each sex. 449 other Navy personnel were asked, depending on their supervisory or nonsupervisory status, to indicate the extent to which they would like to supervise or work with each recruit. It was found that the masculine personality received significantly higher ratings than the feminine personality on the variables of success, attainment, and supervisory preference. However, when compared to the androgynous personality, the masculine personality received a significantly lower rating on coworker preference, and did not differ significantly on any of the other variables. The major sex difference was seen among nonsupervisors, who preferred male to female coworkers. It is concluded that a strictly female personality is not adaptive in the workplace, but that the combination of selected masculine and feminine traits in the androgynous personality is slightly superior to the highly masculine personality. Author (GRA)

N79-19684# Allen Corp. of America, Alexandria, Va.
F-4J/N INSTRUCTIONAL SYSTEM DEVELOPMENT: PHASE 1 Final Report, May - Dec. 1977
William M. Hinton, Jr. Jul. 1978 153 p
(Contract N61339-77-C-0081)
(AD-A061098; NAVTRAEQUIPC-77-C-0081-1) Avail: NTIS HC A08/MF A01 CSCL 05/9

This project was one in a continuing series of studies to upgrade Naval aviation aircrew training programs and at the same time to study the methodology, effectiveness, and resource requirements of Instructional Systems Development (ISD). It was a Phase I effort encompassing ISD steps from hierarchy development through training support requirements analysis. Project goals were to support the Marine and Navy Fleet Readiness Squadrons in their training program development efforts and to study the utility of the 6.2 ISD model in an application to an existing aviation system. The latter goal included gathering information on the strengths and weaknesses of the model, making recommendations for modifications to the model, and collecting resource utilization data. Input data came from a validated list of pilot and RIO tasks which was furnished by the government. Tasks from this list were analyzed into a hierarchical structure of supporting skills and knowledge. This analysis formed the basis for the development of instructional objectives. Preferred and alternate media were selected for each of the objectives. Objectives were then grouped into lessons and the lessons sequenced to form the pilot and RIO syllabi. Finally, a training support requirements analysis was performed to estimate resource requirements for development, implementation, revision, and maintenance of the two training courses. Problems encountered during this program were discussed and recommendations for changes to the ISD model were presented. Author (GRA)

N79-19626# British Aerospace Dynamics Group, Bristol (England).
VISUAL EFFECTS OF HELICOPTER MANEUVRE ON WEAPON AIMING PERFORMANCE
P. R. Michael, T. E. Jardine, and M. K. Goom *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 15 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19630# National Aerospace Lab., Amsterdam (Netherlands).
AN ANALYSIS OF HELICOPTER PILOT CONTROL BEHAVIOR AND WORKLOAD DURING INSTRUMENT FLYING TASKS
J. Smit and Wewerinke *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19633# Centre d'Etudes et de Recherches, Toulon (France).
A DESCRIPTION OF THE RECENT NEUROPSYCHOLOGICAL SELECTION OF PILOTS FOR LAND FORCES LIGHT AIRCRAFT [DESCRITION DE LA NOUVELLE SELECTION NEUROPSYCHOLOGIQUES DES PILOTES DE L'AVIATION LEGERE DE L'ARMEEE DE TERRE]
E. J. Caille, D. Ziane (Aviation Legere de l'Armee de Terre, Villacoublay Air, France), A. Goavec (Antenne-Aviation Legere de L'Armee de Terre, Vincennes, France), and A. Elzear (Antenne-Aviation Legere de l'Armee de Terre, Vincennes, France) *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 6 p (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19648# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
DISORIENTATION IN ROYAL NAVAL HELICOPTER PILOTS
A. P. Steel-Perkins and D. A. Evans (Royal Naval Air Medical School, Hillhead, England) *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 5 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-19685 North Carolina State Univ. at Raleigh.
A MODEL FOR PREDICTING HUMAN DISCOMFORT RESPONSE TO COMBINED NOISE AND VERTICAL VIBRATION Ph.D. Thesis
Jack David Leatherwood 1978 207 p
Avail: Univ. Microfilms Order No. 7905508

The levels and frequency ranges of the noise and vibration stimuli used in this study were selected so that they approximated those encountered in various air and ground transportation systems. Results indicated that accurate prediction of passenger ride comfort requires knowledge of both the level and frequency content of the separate noise and vibration components of a ride environment as well as knowledge of the interactive effects produced by the two stressors acting in combination. Total subjective discomfort response was found to be highly dependent upon the applied levels of vibration, noise, and octave-band frequency. Maximum discomfort responses occurred for noises applied within the 63 Hz and 2000 Hz octave bands. The basic engineering design tradeoffs between passenger discomfort and noise/vibration stimulus levels were quantified by the development of a set of empirical relationships describing the interactive effects between noise level, vibration level, and octave-band frequency. Dissert. Abstr.

N79-19686*# Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
MECHANISMS OF DETERIORATION OF NUTRIENTS

Annual Report, 13 Mar. 1978 - 13 May 1978
Marcus Karel and James M. Flink 1978 239 p refs
(Contract NAS9-12485)
(NASA-CR-160128) Avail: NTIS HC A11/MF A01 CSCL 06H

Methods for improving the quality of freeze-dried foods were investigated. Areas discussed include: (1) microstructure of freeze-dried systems, (2) structural changes in freeze-dried systems, (3) artificial food matrices, and (4) osmotic preconcentration to yield improved freeze-dried products. F.O.S.

N79-19687*# Rockwell International Corp., Downey, Calif. Space Div.
SIMULATED EVA OPERATION OF A REMOTE CONNECTOR ASSEMBLY TEST REPORT Final Report
A. LeFever Feb. 1979 27 p refs
(Contract NAS8-33146)
(NASA-CR-161167; SSD-79-0056) Avail: NTIS HC A03/MF A01 CSCL 05H

The features of a connector concept with respect to timelines and ease of connection by EVA (extravehicular activity), in various mating orientations were evaluated. The connector tests were conducted by thee EVA astronaut test subjects. Each of four test conditions (baseline, off angle, overhead, and with visual obstruction) were run three times by each of the test subjects. Time data were taken on each test run. Visual and voice communications with the subjects were recorded. The tests demonstrated that EVA personnel can perform connection tasks in relatively short times (generally one minute) and the connector configuration was a reasonable design base for such tasks. The in-situ communications and post-test comments indicated that the connector was generally acceptable but requires improvement to its manual interface features. G.Y.

N79-19688*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPARATUS FOR SUPPLYING CONDITIONED AIR AT A SUBSTANTIALLY CONSTANT TEMPERATURE AND HUMIDITY Patent Application
Henry D. Obler, inventor (to NASA) Filed 6 Feb. 1979 29 p
(NASA-Case-GSC-12191-1; US-Patent-Appl-SN-009886) Avail: NTIS HC A03/MF A01 CSCL 06K

An air conditioning system is described which does not require expensive and energy consuming equipment to maintain constant air temperature and humidity. A by-pass duct coupled to a supply duct selectively directs proportions of supplied and return conditioned air around a temperature reducing device. Another by-pass duct coupled to the return duct selectively directs portions of the return circulated air around both the supply duct and the temperature reducing device. A controller device selectively regulates the amount of flow and the mixing of the supplied and return conditioned air flowing through the temperature reducing device, and within the supply duct, the return duct, and the two by-pass ducts. A circulating mechanism within the supply duct moves the supply air, the return conditioned air, and the conditioned air through the various ducts. The apparatus is designed to uniformly control temperature and humidity in computer facilities. NASA

N79-19689# Sierra Engineering Co., Sierra Madre, Calif.
EVALUATION OF THE SIERRA ENGINEERING COMPANY LIGHTWEIGHT HELMET Final Report, May 1976 - Aug. 1977
Duane W. Cowgill, J. A. VanHaastert, William J. Sears (SAM), and Roger L. Stork (SAM) Jun. 1978 55 p refs
(Contract F33615-76-C-0600)
(AD-A061799; SAM-TR-78-13) Avail: NTIS HC A04/MF A01 CSCL 06/17

This report covers the advanced development of a lightweight helmet (LWH) which has recently been evaluated as a candidate for reducing the stress and strain on the neck of aircrew-members exposed to sustained high levels of positive acceleration (- G sub B). During Phase I, Sierra provided ten helmets for testing: six LWHs for the contractor-performed testing of impact and penetration resistance, acoustic attenuation, and windtunnel/antilift characteristics; and four LWHs for USAF-conducted assessments relevant to fit, maintainability, retention/pressure breathing, fixed visual fields, altitude, thermal, acceleration, voice communications effectiveness, chemical-defense equipment, and cockpit compatibility. The HGU-26/P was used as the basis for comparison. During these evaluations, problems were noted in the areas of mask retention, which in turn caused difficulties with pressure breathing and mask slippage during -Gz and fit, which led to visor/spectacle interference and visor/mask incompatibility. During Phase II Sierra provided twenty helmets for flight testing at Nellis AFB in the AIMVAL/ACEVAL program. These helmets were flown in both F-5 and F-15 aircraft. During these evaluations, problems were noted in the areas of liner comfort, chinstrap comfort, and integration with full-length bayonets. Although the helmet was not found acceptable from a comfort/fitting standpoint, the louvered visor cover and flattened side portions of the shell, which reduced aerodynamic lift, were considered a major advance in helmet design. This was in addition to the lower profile, improved peripheral vision, and excellent stability under high G. GRA

N79-19690# Dayton Univ. Research Inst., Ohio.
PHOTOMETRIC METHODS FOR THE ANALYSIS OF HUMAN KINEMATIC RESPONSES TO IMPACT ENVIRONMENTS Final Report, 25 Jun. 1973 - 30 Nov. 1976
P. A. Graf, H. T. Mohlman, and R. C. Reboulet Oct. 1978 248 p
(Contract F33615-73-C-4157; AF Proj. 7231)
(AD-A062006; UDRI-TR-76-88; AMRL-TR-78-94) Avail: NTIS HC A11/MF A01 CSCL 05/5

This report presents the processes, procedures, and techniques developed to evaluate the biodynamic response of body segments to laboratory simulations of aircraft crash and escape system environments. These simulations were conducted on the test facilities, principally the Vertical Drop Tower, the Horizontal Impulse Accelerator, and the Square Wave Impact System, located at the Aerospace Medical Research Laboratory, Impact Branch (presently known as Biomechanical Protection Branch), Wright-Patterson Air Force Base, Ohio, by personnel of that Branch. The processes described were developed to determine the time histories of coordinate locations of anthropometric points during the impact and immediately post impact phases during which the anthropometric points demonstrated planar or nonplanar motion. Coordinate systems were defined for each of the various test facilities. Reference points were marked with fiducials and their coordinates were surveyed. Body segments of the subjects were defined by fiducials affixed to anthropometric points which were measured prior to each test. The tracks of these points were recorded on high speed (500 fps) 16mm motion picture cameras throughout each test event. The film frame coordinates of the points were digitized and electronically processed to define the time-seat coordinate position history of the motion for linear and angular displacement, velocity, and acceleration analysis.
Author (GRA)

N79-19691# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
A METHODOLOGY FOR CONDUCTING HUMAN FACTORS EVALUATIONS OF VEHICLES IN OPERATIONAL FIELD TESTS Final Report
John A. Hicks, III Aug. 1978 47 p refs
(AD-A061808; ARI-RR-1200) Avail: NTIS HC A03/MF A01 CSCL 05/5

The purpose was to develop a standardized methodology for use in conducting human factors evaluations of trucks and similar vehicles within the context of operational field tests. The focus is on the assessment of users' (drivers') judgments and allows for differential weighting of individual human factors characteristics. The key to the methodology is the Human Factors Vehicular Evaluation Instrument, which is an interview form containing 85 human factors characteristics relevant to vehicle design and operation. Data are presented from the initial utilization of the methodology in an operational field test. Author (GRA)

N79-19692# National Highway Traffic Safety Administration, East Liberty, Ohio. Engineering Test Facility.
CALIBRATION OF THREE YEAR OLD CHILD DUMMIES Final Report, Feb. - May 1978
Anthony R. Bayer, Jr. and Robert W. Lum May 1978 382 p
(PB-288961/6; OCW-278/1; DOT-HS-803530) Avail: NTIS HC A17/MF A01 CSCL 13F

Tests were performed to develop appropriate calibration procedures to measure the dynamic response of a three-year-old dummy using acceleration measurements. The calibration procedure consisted of four parts: head impact tests, chest impact tests, head-neck-pendulum tests, and lumbar spine flexion tests. The data from the head impact test, head-neck-pendulum tests and the lumbar spine flexion tests gave repeatable data. The data from the chest impacts were inconsistent. GRA

N79-19612# Army Aeromedical Research Lab., Fort Rucker, Ala.
AN EVALUATION OF THE EFFECTS OF A STABILITY AUGMENTATION SYSTEM UPON AVIATOR PERFORMANCE/WORKLOAD DURING A MEDEVAC HIGH HOVER OPERATION
M. G. Sanders, R. I. Burden, Jr., R. R. Simmons, M. A. Lees, and K. A. Kimball *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19617# Max-Planck-Institut, Bad Kreuznach (West Germany). Anthropotechnics Working Group.
HUMAN EXPOSURE TO MECHANICAL VIBRATION AT LYING POSTURE IN THE AMBULANCE HELICOPTER UH-1D
Heinrich Dupuis *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19623# Army Aeromedical Research Lab., Fort Rucker, Ala.
CHANGES IN THE ROTARY WING AVIATOR'S ABILITY TO PERFORM AN UNCOMMON LOW ALTITUDE REARWARD HOVER MANEUVER AS A FUNCTION OF EXTENDED FLIGHT REQUIREMENTS AND AVIATOR FATIGUE
M. A. Lees, R. R. Simmons, L. W. Stone, and K. A. Kimball *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 14 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19627# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
HUMAN FACTORS EVALUATIONS OF TODAY'S HELICOPTERS AS AN AID TO FUTURE SYSTEMS DESIGN
E. J. Lovesey *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19628# Hughes Helicopters, Culver City, Calif. Human Factors Engineering.
TADRAP: A COMPUTER-AIDED TECHNIQUE FOR REDUCING AIRCREW TASK ANALYSIS DATA
David E. Gobuty *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p ref (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19629# Paris V Univ. (France). Laboratoire d'Anthropologie et d'Ecologie Humaine.
THE USE OF BIOSTEREOMETRY IN HELICOPTER COCKPIT DESIGN [UTILISATION D'UNE METHODE DE BIOSTEREOMETRIE DANS LA CONCEPTION D'UN POSTE DE PILOTAGE D'HELICOPTERE]
A. Coblentz, Y. Deloison, G. Ignazi, and J. Prudent *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 19 p In FRENCH (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19632# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
HUMAN FACTOR ENGINEERING TEST AND EVALUATION OF THE US NAVY LAMPS HELICOPTER SYSTEM
Patrick M. Curran, George J. Laurent, and Paul M. Linton *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 8 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19640# Army Aeromedical Research Lab., Fort Rucker, Ala.
VISUAL PERFORMANCE/WORKLOAD OF HELICOPTER PILOTS DURING INSTRUMENT FLIGHT
R. R. Simmons, M. A. Lees, and K. A. Kimball *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 17 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19642# Federal Aviation Agency, Oklahoma City, Okla. Aviation Physiology Lab.
VISUAL AND OPTICAL ASSESSMENT OF GAS PROTECTIVE FACE MASKS
K. W. Welsh and J. A. Vaughan *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 7 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19644# Italian Air Force Medical Service H. Q., Rome.
SENSORIAL ASPECTS OF HELICOPTER OPERATIONS
Gaetano Rotondo *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 5 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19645# Army Aeromedical Research Lab., Fort Rucker, Ala. Bioacoustics Div.
THE EFFECTIVE ACOUSTIC ENVIRONMENT OF HELICOPTER CREWMEN
Robert T. Camp, Jr. and Ben T. Mozo *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 2 p (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19649# Army Aeromedical Research Lab., Fort Rucker, Ala.
OPERATIONAL CONSIDERATION OF AN/PVS-5 NIGHT VISION GOGGLES FOR HELICOPTER NIGHT FLIGHT
Wun C. Chiou *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 9 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19650# Army Aeromedical Research Lab., Fort Rucker, Ala.
TRAINING REQUIREMENTS FOR HELICOPTER OPERATION WITH NIGHT VISION GOGGLES
Isaac Behar, Dana M. Young, and James E. Johnson *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 4 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19651# Army Aeromedical Research Lab., Fort Rucker, Ala.
HEAD AIMING/TRACKING ACCURACY IN A HELICOPTER ENVIRONMENT
Robert W. Verona *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 18 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19652# Army Aeromedical Research Lab., Fort Rucker, Ala.
AVIATOR VISUAL PERFORMANCE: A COMPARATIVE STUDY OF A HELICOPTER SIMULATOR AND THE UH-1 HELICOPTER
R. R. Simmons, M. A. Lees, and K. A. Kimball *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 13 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

N79-19662# Louisiana State Univ., Shreveport. School of Medicine.
BIOMEDICAL CONSTRAINTS ON THERMAL PROTECTIVE FLIGHT CLOTHING DESIGN: A BIOENGINEERING

ANALYSIS
Francis S. Knox, III, Thomas L. Wachtel (California Univ., San Diego), and Stanley C. Knapp (Army Aeromedical Research Lab., Ft. Rucker, Ala.) *In* AGARD Operational Helicopter Aviation Med. Dec. 1978 11 p refs (For primary document see N79-19605 10-51)
Avail: NTIS HC A99/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N79-19693 Iowa Univ., Iowa City.
THE DESIGN AND APPLICATIONS OF A COMPUTER ARCHITECTURE UTILIZING A SINGLE CONTROL PROCESSOR AND AN EXPANDABLE NUMBER OF DISTRIBUTED NETWORK PROCESSORS Ph.D. Thesis
David Duane Riley 1978 494 p
Avail: Univ. Microfilms Order No. 7902937

The proposed architecture consists of a variable number of independent network processors (NETPRs) utilizing a single control processor (CONPR) for synchronization and data loading. The NETPRs communicate with the CONPR through an associative communication network. In addition, a distributed communication network is included to handle inter-NETPR communications in the form of short messages. The utility and performance of the proposed architecture was evaluated for a particular software application, the processing of GPSS programs. For this application individual NETPRs are assigned the responsibility of simulating a transaction, facility, queue, storage, or savevalue. For sufficiently complex GPSS models the proposed application is an effective method of processing GPSS. Methods for improving this application and suggestions for several other effective applications of the proposed architecture are also discussed. Dissert. Abstr.

N79-19694 Nebraska Univ. - Lincoln.
ISSUES IN THE DESIGN OF A GEOGRAPHICAL DATA PROCESSING SYSTEM: A CASE STUDY Ph.D. Thesis
Sharad Ghanashyam Wagle 1978 212 p
Avail: Univ. Microfilms Order No. 7901948

Four areas of research were identified in the field of geographical data processing: digitization procedure, data structures, inter-entity relations, and algorithms. Research in these areas was carried out within the scope of a particular geographical data processing system that was developed and reported. The STANDARD (Storage and Access of Network Data on Rivers and Drainage Basins) system, which processes data on rivers and basins digitized from U.S. Geological Survey topographic maps and produces drainage-area and profile reports is presented. Specific contributions reported include: extensive use of graphical context to reduce data entry effort; a programming language view of the digitization procedure; extension of the conventional lexical analysis techniques to include graphical analysis; classification of geographical entities and attributes; a basin reconstruction algorithm; and a new traversal of binary trees.
Dissert. Abstr.

N79-19695 Wisconsin Univ. - Madison.
THE EVALUATION OF ABSTRACT DATA TYPES AS AN IMPLEMENTATION TOOL FOR DATABASE MANAGEMENT SYSTEMS Ph.D. Thesis
Anthony James Baroody, Jr. 1978 243 p
Avail: Univ. Microfilms Order No. 7822235

The application of current research on abstract data types and on generic procedures to the implementation of a network model database management system was examined. A generic procedure model of a database management system is presented and used to describe the techniques used in current systems to provide these descriptors to the data manipulation routines. To preserve data independence, an approach employing run-time interpretation is used. A simulation model is developed to compare the abstract data type model with the interpretive approach. The simulation model is used in combination with analytic modeling to study the locality of references to schema descriptors, the effect of multiprogramming on system overhead, and the effect of mass storage I/O time on system performance.
Dissert. Abstr.

N79-19696 State Univ. of New York at Stony Brook.
THE DESIGN AND PERFORMANCE OF A HIERARCHICAL MULTI/MICROPROCESSOR Ph.D. Thesis
J. Archer Harris 1978 243 p
Avail: Univ. Microfilms Order No. 7904992

A multiprocessor architecture is designed around local rather than shared memory and which emphasizes structure and standard modules at both the hardware and software levels. Particular attention is paid to creating an architecture which simplifies the creation and modification of reliable parallel programs. Two applications, the NF-complete traveling salesperson problem and the artificial intelligence checker playing problem, each have an algorithm for their solution converted into a parallel algorithm designed to run on the architecture. While simulating the multi/microprocessor running the two algorithms, various processor tree fan-outs were tested. Data is presented which was gathered from these simulations and includes processor utilization, total computation time, and processor delays due to communication inefficiencies in the architecture. Dissert. Abstr.

N79-19697 George Washington Univ., Washington, D. C.
A DESCRIPTIVE STUDY OF THE RELATIONSHIPS BETWEEN SELECTED ORGANIZATIONAL VARIABLES AND THE NATURE OF THE DATA BASE ADMINISTRATOR Ph.D. Thesis
Donald Gerald Pursley 1978 123 p
Avail: Univ. Microfilms Order No. 7904702

Despite the well-documented need for a systematic approach to the organizational development of the data base administrator (DBA), management was given few guidelines for implementing such a concept. This study focuses on providing such an approach so that the role of DBA, which was defined as the function within an organization which was responsible for the design, creation, integrity, efficiency, and administrative activities of a data base, can be effectively integrated into the managerial hierarchy. Empirical data was gathered on the DBA from a questionnaire mailed to 232 organizations that have this function. The questionnaire measures the environmental variables of stability, complexity, and sensitivity of the organizational data base and the complexity of the data base users. In addition, the organizational development of the DBA in terms of evolutionary pattern, organizational structure, and qualifications of those who man the function were measured. Dissert. Abstr.

N79-19698 California Univ., Berkeley.
APPLICATIONS OF AUTOMATA THEORY TO THE DESIGN OF INTELLIGENT MACHINES Ph.D. Thesis
William John Sakoda 1978 88 p
Avail: Univ. Microfilms Order No. 7904594

The computational complexity of inferring grammars for various language classes from finite samples is considered. The capability of cooperating finite state machines moving on 2 and 3 dimensional obstructed checkerboards is discussed.
Dissert. Abstr.

N79-19699 Ohio State Univ., Columbus.
DESIGN OF A MIXED VOICE/DATA TRANSMISSION SYSTEM FOR COMPUTER COMMUNICATION Ph.D. Thesis
Jin-Tuu Wang 1978 276 p
Avail: Univ. Microfilms Order No. 7902242

This research attempts to find an inexpensive way of providing such digital data communication links by inserting or embedding digital data (in packets) into the silent periods of voice conversation in a four-wire telephone transmission system. In implementating the MVD System, a packet-oriented interprocessor communication protocol is designed to provide a flexible three-quarters full-duplex operation between the transmitting and receiving microcomputers. The operating principle and functional requirements are also presented, followed by the detailed hardware implementation. This implementation consists of realizations of various components in the line interface circuits. Finally, the system design of a software operating system is presented. In this operating system, a software structure is created based on the MVD system operating principles and its functional requirements. Dissert. Abstr.

N79-19700*# Michigan Univ., Ann Arbor.
PERFORMABILITY EVALUATION OF THE SIFT COMPUTER
J. F. Meyer, D. G. Furchtgott, and L. T. Wu Jan. 1979 40 p refs
(Grant NsG-1306)
(NASA-CR-158249; SEL-127; Rept-01524-5-T) Avail: NTIS HC A03/MF A01 CSCL 09B

Performability modeling and evaluation techniques are applied to the SIFT computer as it might operate in the computational evironment of an air transport mission. User-visible performance of the total system (SIFT plus its environment) is modeled as a random variable taking values in a set of levels of accomplishment. These levels are defined in terms of four attributes of total system behavior: safety, no change in mission profile, no operational penalties, and no economic process whose states describe the internal structure of SIFT as well as relavant conditions of the environment. Base model state trajectories are related to accomplishment levels via a capability function which is formulated in terms of a 3-level model hierarchy. Performability evaluation algorithms are then applied to determine the performability of the total system for various choices of computer and environment parameter values. Numerical results of those evaluations are presented and, in conclusion, some implications of this effort are discussed. Author

N79-19701*# Michigan Univ., Ann Arbor. Systems Engineering Lab.
MODELS AND TECHNIQUES FOR EVALUATING THE EFFECTIVENESS OF AIRCRAFT COMPUTING SYSTEMS Semiannual Status Report, 1 Jun. - 30 Nov. 1978
John F. Meyer Jan. 1979 12 p refs
(Grant NsG-1306)
(NASA-CR-158247; SEL-129; Rept-014524-7-T; SASR-5) Avail: NTIS HC A02/MF A01 CSCL 09B

System models that provide a basis for the formulation and evaluation of the performability of commercial aircraft computer system are developed. Quantitative measures of the system effectiveness are formulated. Analytic and simulation techniques for evaluation of the effectiveness and performability of a proposed or existing aircraft computer were studied. S.E.S.

N79-19702# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
LABORATORY FOR COMPUTER SCIENCE (FORMERLY PROJECT MAC) Annual Progress Report, 1 Jan. - 31 Dec. 1978
M. L. Dertouzos 10 Oct. 1978 146 p
(Contract N00014-75-C-0661)
(AD-A061932; LCS-PR-14) Avail: NTIS HC A07/MF A01 CSCL 09/2

Annual Summary Report of progress made at the Laboratory for Computer Science under this contract during the period January-December 1978. Author (GRA)

N79-19703# Army Construction Engineering Research Lab., Champaign, Ill.
A SURVEY OF THE PROPERTIES OF COMPUTER COMMUNICATION PROTOCOLS. VOLUME 2: FUTURE DEVELOPMENTS OF COMPUTER NETWORK PROTOCOLS
J. W. S. Liu and M. D. Mickunas Sep. 1978 37 p refs
(AD-A061647; CERL-TR-O-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report is the second part of a two-part study on the properties of computer communication protocols. It is concerned primarily with the future development of protocols, particularly a projection of the state of the art of protocols of different levels. The packet switching network is explained, and the possible future developments in low-level protocols are discussed, including end-to-end protocols and user-level protocols that support functions such as file transfer and remote job entry.
Author (GRA)

N79-19704# Department of Defense, Washington, D. C.
OPTIMIZATION OF A COMPUTER SECURITY INDEX VERSUS COST
Richard P. Wissing Jun. 1978 67 p
(AD-A062003) Avail: NTIS HC A04/MF A01 CSCL 15/3

In this paper, a computer security index for measuring the security of computer systems and a strategy for purchasing computer security countermeasures in a cost effective manner were proposed. Required inputs for the model include definition of threats and countermeasures, relative importance of threats, costs of countermeasures, and the effectiveness of each countermeasure against each of the threats listed. If a standardized list of threats and countermeasures can be developed, the computer security index could also be used to compare the security of different computer systems. Author (GRA)

N79-19705# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
RABBIT: A COMPILER FOR SCHEME (A DIALECT OF LISP). A STUDY IN COMPILER OPTIMIZATION BASED ON VIEWING LAMBDA AS RENAME AND PROCEDURE CALL AS GOTO USING THE TECHNIQUES OF MACRO DEFINITION OF CONTROL AND ENVIRONMENT STRUCTURES. SOURCE-TO-SOURCE TRANSFORMATION PROCEDURE INTEGRATION AND TAIL-RECURSION M.S. Thesis
Guy Lewis Steele, Jr. May 1978 275 p refs
(Contract N00014-75-C-0643)
(AD-A061996; AI-TR-474) Avail: NTIS HC A12/MF A01 CSCL 09/2

A compiler for the lexically-scoped dialect of LISP known as SCHEME was developed. The compiler knows relatively little about specific data manipulation primitives such as arithmetic operators, but concentrates on general issues of environment and control. Rather than having specialized knowledge about a large variety of control and environment constructs, the compiler handles only a small basis set which reflects the semantics of lambda-calculus. All of the traditional imperative constructs, such as sequencing, assignment, looping, GOTO, as well as many standard LISP constructs such as AND, OR, and COND, are expressed as macros in terms of the applicative basis set. A small number of optimization techniques, coupled with the treatment of function calls as GOTO statements, serve to produce code as good as that produced by more traditional compilers. The macro approach enables speedy implementation of new constructs as desired without sacrificing efficiency in the generated code. GRA

N79-19706# Tracor, Inc., Austin, Tex.
DEVELOPMENT AID FOR AN EMULATING MICROPROCESSOR Final Report, 14 Feb. 1977 - 28 Feb. 1978
R. Fosdick Jun. 1978 33 p
(Contract F33615-77-C-1115)
(AD-A061812; AFAL-TR-78-77) Avail: NTIS HC A03/MF A01 CSCL 09/2

This is the final report of a program initiated to implement a complete emulator utilizing the GPU circuit. When it was discovered that the GPU was going to require some mask changes the effort was redirected to start the definition of the LSI Micro Controller Circuit and to start developing an LSI Simulator for systems interface verification. This report covers work performed to establish the initial requirements and characteristics of a high performance microprogram controller IC. Some key elements of the study were: op-code decomposition techniques of target machines, definition of the controller function, and architecture of target machines with regards to requirements for the controller IC. The information developed under this contract will be of direct use in a follow-on contract to design and develop the controller IC. Author (GRA)

N79-19707# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
FLOWSHOP SCHEDULING WITH LIMITED TEMPORARY STORAGE
Christos H. Papadimitriou and Paris C. Kanellakis Mar. 1978 43 p refs
(Grants NSF APR-76-12036; NSF MCS-77-01192)
(PB-288913/7; ESL-P-808) Avail: NTIS HC A03/MF A01 CSCL 09B

The problem of scheduling 2-machine flowshops in order to minimize makespan, using a limited amount of intermediate storage buffers was examined. Although there are efficient algorithms for the extreme case of zero and infinite buffer capacities, it is shown that all the intermediate (finite capacity) cases are NP-complete. Exact bounds are proven for the relative improvement of execution times when a given buffer capacity is used. An efficient heuristic is analyzed for solving the 1-buffer problem, showing that it has a 3/2 worst-case performance. The no-wait (i.e., zero buffer) flowshop scheduling problem with 4 machines which is NP-complete is discussed. GRA

N79-19708# Office of Management and Budget, Washington, D. C. Information Systems Policy Div.
FEDERAL DATA PROCESSING POLICIES AND REGULATIONS: AN ANNOTATED BIBLIOGRAPHY OF LAWS, POLICIES, REGULATIONS AND OTHER DOCUMENTS PERTAINING TO THE MANAGEMENT OF FEDERAL DATA PROCESSING AND RELATED TELECOMMUNICATIONS ACTIVITIES Final Report
Dec. 1978 50 p
(PB-290183/3) Avail: NTIS HC A03/MF A01 CSCL 09B

The major laws, government-wide policies, and regulations which affect the acquisition, management, and use of data processing and related telecommunications resources by the Federal Government are presented. This bibliography contains 188 abstracts. GRA

N79-19056*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INITIAL ECONOMIC AND OPERATIONS DATA BASE FOR DSS 13 AUTOMATION TEST
D. S. Remer and G. Lorden *In its* The Deep Space Network 15 Feb. 1979 p 78-85 ref (For primary document see N79-19045 10-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

N79-19984# Joint Publications Research Service, Arlington, Va.
PROTOTYPE OF DATA TRANSFER MULTIPLEXER TESTED IN USSR
In its Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 61 (JPRS-72988) 13 Mar. 1979 p 5-9 Transl. into ENGLISH from Szamitastechnika (Budapest), 8 Dec. 1978 p 4 (For primary document see N79-19983 10-99)
Avail: NTIS HC A04/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-19709 Texas Univ. at Dallas.
THREE-DIMENSIONAL MODELING OF OBJECTS FROM NOISY SILHOUETTES, WITH APPLICATION TO MYOCARDIAL INFARCT SIZING Ph.D. Thesis
Margaret Hartzel Lewis 1978 180 p
Avail: Univ. Microfilms Order No. 7902526

A model is constructed from the intersection of three-dimensional cylinders determined by outlines of the object obtained from various angles. The resulting model forms an envelope which encloses and bounds the object in question. The effectiveness of the envelope models for infarct sizing was tested with experimentally produced myocardial infarcts(MIs) in dogs for which actual infarct size could be estimated. Model-based volume estimates were correlated with histologic infarct size for two series of data: one series of anterior wall MIs and one series of infero/posterior MIs. Dissert. Abstr.

N79-19710 Texas Univ. at Dallas.
SEMANTIC SIMILARITY ANALYSIS: A COMPUTER-BASED STUDY OF MEANING IN NOUN PHRASES WITH EXAMPLES FROM MEDICAL TEXT Ph.D. Thesis
Lynn Louise Meister Peterson 1978 245 p
Avail: Univ. Microfilms Order No. 7902530

The concept of semantic similarity, as measured by a similarity index, the value of a function on the domain of pairs of natural language strings, specifically noun phrases of medical text, is investigated. Techniques for generating such a similarity index are developed and investigated in the light of improvements in meaningfulness and usefulness for retreival of desired records generated by changes in (1) weighting schemes called user profiles which can be tailored to individual users, and (2) similarity measures which are functions in the form of correlation measures. The semantic analysis which underlies this measurement is carried out using the techniques developed in the MEANINGEX system in which the semantic information is carried in a vocabulary, whose general form is that of a hierarchical lexicon, and an accompanying set of synonyms and implications. Dissert. Abstr.

N79-19711 Washington State Univ., Pullman.
GRAMMAR TRANSFORMATIONS BASED ON REGULAR DECOMPOSITIONS OF CONTEXT-FREE DERIVATIONS Ph.D. Thesis
Rockford James Ross 1978 161 p
Avail: Univ. Microfilms Order No. 7903592

Four transformations on an arbitrary context free grammar G are given based on the following observation: each complete derivation in G--one which produces a word in L(G) from the start symbol--can be decomposed into prime derivations which are essentially regular in form. Each prime derivation induces a finite set of regular expressions, each of which becomes an internal symbol in the transformed grammar. One of these transformations, H1, is examined. Dissert. Abstr.

N79-19712 Wisconsin Univ. - Madison.
INFERRING CONCEPTUAL STRUCTURES FROM PICTORIAL INPUT DATA Ph.D. Thesis
Sharon Caroline Salveter 1978 130 p
Avail: Univ. Microfilms Order No. 7820648

The mechanisms a program may use to learn conceptual structures that represent natural language meaning were investigated. A computer program named Moran is described. Moran is presented snapshots of an environment and an English sentence describing the action that takes place between the snapshots. The learning task is to associate each root verb with a conceptual structure that represents the types of objects that participate in the action and the change the objects undergo during the action. Four learning mechanisms are shown to be adequate to accomplish this learning task. The learning mechanisms are described along with the conditions under which each is invoked and the effect each has on existing memory structures. The conceptual structures that Moran infers for seventeen senses of four root verbs are shown. Dissert. Abstr.

N79-19713 State Univ. of New York at Stony Brook.
STRUCTURE OF CONCURRENT PROGRAMS EXHIBITING REPRODUCIBLE BEHAVIOR Ph.D. Thesis
Fred Barry Schneider 1978 175 p

Avail: Univ. Microfilms Order No. 7901809

The ability to reproduce the behavior of a program is taken for granted when writing sequential programs. However, in the case of concurrent programs, reproducibility may not be assumed. This is due to the fact that each process will progress at an undefined speed. Thus, the order in which processes access this data remains unspecified. Furthermore, the rate of progress of a process in the system may depend on unpredictable factors. Consequently, it may be very difficult to reproduce the behavior of a program since the results produced may depend on a particular sequence of events which can not be controlled. A set of reasonable language restrictions in terms of the Concurrent Pascal programming language is proposed. These restrictions impose sufficient structure on a system so that nonreproducible behavior can not occur. Dissert. Abstr.

N79-19714 Rensselaer Polytechnic Inst., Troy, N. Y.
INVARIANT ASSERTION SYNTHESIS AND THEOREM GENERALIZATION IN PROGRAM VERIFICATION Ph.D. Thesis
Jan Vytopil 1978 132 p
Avail: Univ. Microfilms Order No. 7903216

Syntax of Godel's arithmetical predicates is given, and an algorithm to generate the minimal predicate (strongest invariant assertion) of a cutpoint in a flow chart as a (first-order) arithmetical predicate is presented. This algorithm is linear in time as function of program length. The complexity of invariant assertion synthesis dependent upon the syntax used to express the assertions was examined. Heuristics for synthesizing nice assertions are developed. Recursive programs and why some of the theorems about such programs are difficult to prove by induction are discussed. A method to generalize theorems about two classes of programs to make them amenable to proof by induction is presented. Invariant assertions are obtained as a by-product of this generalization process. A method for redefining the functions representing given programs in order to simplify the proof of certain properties of these programs is reported. Dissert. Abstr.

N79-19715 Massachusetts Univ., Amherst.
LEARNING = INTERPRETATION + GENERALIZATION: A CASE STUDY IN KNOWLEDGE-DIRECTED LEARNING Ph.D. Thesis
Elliot Morris Soloway 1978 132 p
Avail: Univ. Microfilms Order No. 7903844

The crucial role which domain knowledge plays in the interpretation and generalization phases of the learning process is explored. The setting for this work is the competitive action game of baseball; a system is described which acquires rules that relate the observed actions of the players to their goals in the game. Multiple levels of knowledge and processing are used to transform the input description of physical activity (e.g., run, catch, throw) into the desired generalized interpretations (e.g., hits, outs.). The data-directed (DDG) and the knowledge-directed (KDG) approaches to generalization were examined. Domain knowledge must enter the learning loop in order for a system to learn. In systems which employ DDG, that knowledge is supplied by some external source, whereas in the KDG system, that knowledge has been made explicit and provided to the system itself. Dissert. Abstr.

N79-19716 Pittsburgh Univ., Pa.
ANALYSIS OF PROGRAM STRUCTURE FOR TEST INPUT GENERATION IN A SUCCESSIVE TESTING ENVIRONMENT Ph.D. Thesis
Hikyoo Koh 1978 188 p
Avail: Univ. Microfilms Order No. 7902768

Problems in the design of a test input generation system in a successive testing environment were investigated. The program digraph is decomposed into its subgraph, called intervals, whose boundaries are mostly outermost loops of the program, so that a series of closely related error corrections are confined to just one interval or two, and various relationships among loops are identified insomuch as they affect the sequence in which loops are combined to form a progam execution path. The portion of the program digraph affected by error corrections is identified, and it, instead of the whole program digraph, is traversed in order to analyze its structure. Computation costs are compared between the new approach and the approach that is based on traversal of the entire program digraph. Dissert. Abstr.

N79-19717 State Univ. of New York at Stony Brook.
ON REDUCIBILITY, STRUCTURE, AND THE NEED AND USE OF FLAGS Ph.D. Thesis
John Joseph Keohane 1978 184 p
Avail: Univ. Microfilms Order No. 7902041

Some of the capabilities and limitations of various sets of control structures were investigated. More specifically, relationships within the hierarchy of structured flowcharts (D-charts, RE sub 1-charts,...,RE sub n-charts,...)are clarified. The relationship between reducible flowcharts and RE sub n-charts is examined. The use of auxiliary logical variable (flags)to structure RE sub n-charts further is discussed. Dissert. Abstr.

N79-19718 Massachusetts Univ., Amherst.
THE USE OF FRAME-TO-FRAME DIFFERENCES IN ENCODING COMPUTER GRAPHICS DATA IN A NETWORK ENVIRONMENT Ph.D. Thesis
Arthur Israel Karshmer 1978 177 p
Avail: Univ. Microfilms Order No. 7902029

A solution to the problems associated with the transmission of large volumes of computer graphics data over low speed lines in a network environment is defined. The graphics application used is computer generated animation as it represents a class of graphics applications which contain a high degree of redundant information from one display to the next. The encoding technique is able to achieve a dramatic level of data which contain a high level of redundant information. Data and graphs are shown which compare the research system to both stand-alone animation on a minicomputer as well as another method of data encoding used in a network environment. The encoding method used is shown to be superior to the other approaches. While the research system has not been fully implemented its major components have been implemented and fully tested. Most of the algorithms used in the current research are specified in the thesis in an Algol like notation. Dissert. Abstr.

N79-19719 Columbia Univ., New York.
COMPUTATION MODELS AND SCHEDULING OF SYNCHRONIZED PARALLEL SOLUTION OF LINEAR EQUATIONS Ph.D. Thesis
John Wen-chih Huang 1978 240 p
Avail: Univ. Microfilms Order No. 7904087

The principle of parallel pipelining is described. To expose parallelism, the solution process is formulated as a multi-task system, where each task is a set of one or two numeric operations. Transport delay is introduced into the system to represent multistage pipelining and partial pivoting. The task system is represented by a directed acyclic graph called task graph. For a sparse matrix, the task graph is determined by the pivoting order and the sequence of update (a multiplication followed by an addition) operations. Heuristic algorithms to generate desirable task systems are proposed. For a full matrix, the task graph is represented by a simplified schematic diagram. Dissert. Abstr.

N79-19720 California Univ., Irvine.
POWER EFFICIENCY, AND CORRECTNESS OF TRANSFORMATION SYSTEMS Ph.D. Thesis
Dennis Francis Kibler 1978 215 p
Avail: Univ. Microfilms Order No. 7906401

The test bed is a LISP program, SPECIALIST, which performs a limited type of source-to-source program optimization is presented. The major power of SPECIALIST lies in its ability to simplify programs when the data structure is contrained by a local predicate. SPECIALIST simplifies matrix computation programs. Transformations, without backup or user assistance, are provided, and the time complexity of an algorithm are reduced. Dissert. Abstr.

N79-19721 Stanford Univ., Calif.
A METHOD FOR DETERMINING THE SIDE EFFECTS OF PROCEDURE CALLS Ph.D. Thesis
John Phineas Banning 1978 294 p
Avail: Univ. Microfilms Order No. 7905815

A method is presented for determining exit and variable side effects of procedure calls in a programming language, and

an algorithm for determining the aliases of variables is given. The principal advantage over previous methods is that only one pass over a program is used to gather the information needed to compute certain variable side effects precisely, even in the presence of recursion and reference parameters. These methods can be extended to cover programs with a number of features including procedure and lable parameters. An abstract model of block-structured programs is developed and used to prove that the methods given yield approximations which are safe for use in program optimization and, for certain side effects, are at least as precise as those given by any previous method. The implementation of these methods is discussed, and a particular implementation for the programming language PASCAL is described. The results of an empirical study of side effects and aliases in a collection fo PASCAL programs are also presented.

Dissert. Abstr.

N79-19722 California Univ., Berkeley.
ON PARTITIONING A GRAPH: A THEORETICAL AND EMPIRICAL STUDY Ph.D. Thesis
Robert Malcolm MacGregor 1978 178 p
Avail: Univ. Microfilms Order No. 7904534

A combinatorial problem called the k-partition problem is studied: 'given an undirected graph G and an integer k, divide the nodes of G into k equal-sized sets in a way which minimizes the number of arcs which connect nodes in different sets.' The problem is shown to be NP-complete even when the maximum node degree of G is at most three. A variant of the problem, the general partition problem is also proved to be NP-complete. A probabilistic analysis proves that on a very simple set of graphs the simplest of the iterative improvement algorithms almost surely produces a 2-partition which is far from optimal. Empirical tests showed that more complex iterative improvement strategies also fail to find good solutions on these graphs. Heuristics which augment the standard iterative improvement techniques were developed and approaches for extending 2-partition algorithms to find k-partitions are proposed. Properties of the 2-partition problem are investigated for special types of graphs.

Dissert. Abstr.

N79-19723 California Univ., Los Angeles.
IMAGE AREA-PARTITIONS Ph.D. Thesis
Joseph Olusesan Omolayole 1978 194 p
Avail: Univ. Microfilms Order No. 7906188

Techniques for reducing stored portions of digitzed images while retaining prominent structures are presented. An area partitioning scheme is used in combination with proven image processing techniques to organize the subquadrants of an image into several levels using a tree structure. The object-structure is better preserved using content adaptive criterion (CAÇ) than using NSC in all the image examples, although CAC required more storage. An image directory for one sample picture is presented. The procedure developed can be used to facilitate recording of the geographical locations of objects, as well as their relationship with other visual features.

Dissert. Abstr.

N79-19724 Purdue Univ., Lafayette, Ind.
DATA-FLOW GRAPHS AS AN INTERMEDIATE PROGRAM FORM Ph.D. Thesis
Karl Joseph Ottenstein 1978 297 p
Avail: Univ. Microfilms Order No. 7905807

A Data-Flow Graph (DFG) consists of a cyclic data-dependency graph and an associated control-flow graph. Methods for translating certain source programs in conventional programming languages into DFG's are given along with methods for generating target programs in similar languages. Several transformations on DFG's are discussed. Simple graph-marking algorithms for performing scalar propagation, subsumption, dead code removal and constant propagation are presented. All of these algorithms, along with certain expression optimizations, require near linear time with respect to the size of the graph. An algorithm for performing redundant common subexpression elimination on programs with reducible control-flow graphs is presented which is more complete than any other known practical algorithm.

Dissert. Abstr.

N79-19725 California Univ., Berkeley.
THE FILE STORE: A DISTRIBUTED MODULAR FILE HANDLING SYSTEM Ph.D. Thesis
Brian John Phillips 1978 211 p
Avail: Univ. Microfilms Order No. 7904575

The file section of a modern operating system was analyzed and functionally decomposed so that the tasks can be handled by a small computing unit. By using a number of computing units, a large number of user and system tasks can be handled concurrently. Using modular parts, a proposed multisystem, the file store, was designed to replace the file handling section of a general purpose computer system to illustrate the concepts involved. The modular system provided for easy incremental expansion to handle changes in load, capacity, processing rate, and other system requirements rather than requiring replacement of an original system with one of greater capacity. Also, new and developing devices present opportunities to upgrade and structure modular systems closer to to their application requirements. At the logical level, the system was composed of processes and files.

Dissert. Abstr.

N79-19726 Maryland Univ., College Park.
AUTOMATIC SUBROUTINE GENERATION IN AN OPTIMIZING COMPILER Ph.D. Thesis
Jeffrey Brian Shaffer 1978 144 p
Avail: Univ. Microfilms Order No. 7906686

It is demonstrated that the string and directed acyclic graph subroutine generation problems are both NP-complete. An approximation algorithm is presented for both simplified problems, based on a greedy heuristic. Worst case performance bounds are derived for this algorithm and other heuristics are discussed. Two subroutine generation algorithms are presented that operate in polynomial time and linear space. The algorithms are based on the iterative greedy heuristic for simplified problems. Subroutines with the highest obtainable cost saving are repeatedly created until no new subroutine candidates can be found.

Dissert. Abstr.

N79-19727 Purdue Univ., Lafayette, Ind.
THREE DIMENSIONAL DISPLAY PROCESSING - IMPLEMENTATION OF A REAL TIME SYSTEM Ph.D. Thesis
Garrett Ward Stowell 1974 220 p
Avail: Univ. Microfilms Order No. 7905678

The processing of three dimensional line drawings in real time requires specialized hardware to aid in the rapid computation of transformation and viewing algorithms. The author's design endeavors to strike a set of cost effective compromises using current technology to produce a general add-on type, real time, three dimensional display processor. Serving as a convenient host is an Interdata Model 70 minicomputer with 8K of memory which is shared with the display hardware through the manufacturer supplied, general direct memory access interface. Chosen for implementation was the homogeneous coordinate formulation with full high speed 4 by 4 matrix concatenation and vector transformation performed in hardware to any length. Perspective projection logic is implemented as an adjunct to the matrix unit. Vector generation is performed by modified binary rate multiplier logic.

Dissert. Abstr.

N79-19728 Stanford Univ., Calif.
SET REPRESENTATION AND SET INTERSECTION Ph.D. Thesis
Luis Isidoro Trabb Pardo 1978 88 p
Avail: Univ. Microfilms Order No. 7905939

The representation and manipulation of sets based on two different concepts are discussed: tries, and hashing functions. The sets considered here are assumed to be static: A worst case improvement technique is investigated. A statistical model is used to investigate the average behavior of the intersection algorithms. The model considers the estimated magnitude of the intersections. Problems due to hashing, arising with the random access patterns are discussed and solutions are presented. Set union and the tradeoffs involved in the practical applications of the techniques are described.

Dissert. Abstr.

N79-19729 City Univ. of New York.
THE DESIGN OF A PROGRAMMABLE REAL TIME ADM VOICE PROCESSOR AND THE FORMULATION OF THE AUTOCORRELATION FUNCTION FOR THE LDM ALGORITHM Ph.D. Thesis

Tuvia Apelewicz 1979 202 p
Avail: Univ. Microfilms Order No. 7902540

Design requirements for the voice processor are established. A specific processor configuration is chosen and an instruction set is developed. Several delta modulation encoder algorithms and a programmable decoder capable of receiving them are implemented. A Markov chain approach is used in obtaining the autocorrelation function of the linear delta modulation system. An algorithm, to obtain the transition probabilities matrix and the steady state level probabilities, is developed for the zero-order and first-order Markov cases. Dissert. Abstr.

N79-19730 California Univ., Berkeley.
LINEAR DECISION MODELS UNDER RISK Ph.D. Thesis
Terry Roger Harms 1978 127 p
Avail: Univ. Microfilms Order No. 7904471

Stochastic programs where the random aspect of the coefficients in the objective function, technology matrix, and the vector of resources are taken into account is developed. The problem of a linear program with uncertainty attached to the decision vector was investigated. The chance-constrained approach to formulate two models was studied. A set of random variables for which conservative approximations are easily obtainable linear programs are presented. Bounds on the optimal value of the objective function are defined. A problem of trade-off between the cost of reducing the variance of the uncertainties versus the corresponding improvement in the objective function is defined and a simple algorithm is presented to solve this problem. Finally, we outline how some of the results can be applied to more general chance-constrained programs and conservative approximations can be defined for these more general models.
Dissert. Abstr.

N79-19731 California Univ., Berkeley.
RANDOMLY GENERATED LINEAR PROGRAMS Ph.D. Thesis
Sancho Eduardo DeBittencourt Berenguer 1978 88 p
Avail: Univ. Microfilms Order No. 7904376

Random variables are assumed to be independent and symmetric around zero and to have continuous distribution functions. The theory of d-Arrangements was used to compute the probabilities of P being feasible and bounded; and the expected number of faces of all possible dimensions of the polyhedron that is the constraint set of P, given that P is feasible was calculated. Duality in randomly generated linear programs was investigated. The dual problem of P that has properties that are analogous to those of the random primal problem is shown. The concept of the core of a linear program and the concept of economically binding and economically redundant constraints in the contex of randomly generated programs are studied.
Dissert. Abstr.

N79-19732 California Univ., Berkeley.
SIMULATION OF INTEGRATED INJECTION LOGIC Ph.D. Thesis
Graeme Robert Boyle 1978 203 p
Avail: Univ. Microfilms Order No. 7904387

A computer program, SIMPIL, is developed to simulate large-scale Integrated Injection Logic (I2L) circuits. The analysis techniques used in SIMPIL are based on those used in MOTIS-like timing simulators; however, SIMPIL is written for the specific analysis of multi-collector bipolar transistor circuits. The program is written in FORTRAN for a CDC CYBER computer and can analyze circuits consisting of up to 4096 I2L gates. SIMPIL has four main sections: the model preprocessor, circuit equation setup, analysis and output. Models constructed from resistors, diodes and transistors for I2L simulation using a conventional circuit simulator such as SPICE2 are presented, and a procedure to enable all parameters for the models to be determined is described. Dissert. Abstr.

N79-19733*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FASTER FOURIER TRANSFORMATION: THE ALGORITHM OF S. WINOGRAD
Shalhav Zohar 15 Feb. 1979 99 p refs
(Contract NAS7-100)
(NASA-CR-158230; JPL-Pub-78-104) Avail: NTIS HC A05/MF A01 CSCL 09B

The new DFT algorithm of S. Winograd is developed and presented in detail. This is an algorithm which uses about 1/5 of the number of multiplications used by the Cooley-Tukey algorithm and is applicable to any order which is a product of relatively prime factors from the following list: 2,3,4,5,7,8,9,16. The algorithm is presented in terms of a series of tableaus which are convenient, compact, graphical representations of the sequence of arithmetic operations in the corresponding parts of the algorithm. Using these in conjunction with included Tables makes it relatively easy to apply the algorithm and evaluate its performance. M.M.

N79-19734*# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
METAPHOR: PROGRAMMER'S GUIDE, VERSION 1
D. G. Furchtgott Jan. 1979 256 p
(Grant NsG-1306)
(NASA-CR-158251; SASR-5; SEL-128; Rept-014524-6-T)
Avail: NTIS HC A12/MF A01 CSCL 09B

The internal structure of the Michigan Evaluation Aid for Perphormability (METAPHOR), an interactive software package to facilitate performability modeling and evaluation is described. Revised supplemented guides are prepared in order to maintain an up-to-date documentation of the system. Programmed tools to facilitate each step of performability model construction and model solution are given. S.E.S.

N79-19735# Electronics Research Lab., Adelaide (Australia).
POLYNOMIAL MANIPULATION WITH APL
B. Billard Apr. 1978 24 p refs
(AD-A061797; ERL-0004-TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

A simple but effective system for the manipulation of polynomials of several variables in APL is presented. The system is especially advantageous in situations where more sophisticated symbolic computing systems are not available, or have failed to solve particular problems. The system is shown to successfully solve a problem not resolved by a more sophisticated system.
Author (GRA)

N79-19736# Stanford Univ., Calif. Systems Optimization Lab.
SPECIALLY STRUCTURED MATHEMATICAL PROGRAMMING PROBLEMS Final Report, 1 Jun. 1974 - 31 Aug. 1978
Richard W. Cottle and Frederick S. Hillier 31 Oct. 1978 11 p refs
(Contract F44620-74-C-0079)
(AD-A062029; AFOSR-78-1499TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This final report summarizes the most important results obtained under this contract. This research was carried on in the Systems Optimization Laboratory as part of an integrated program of theoretical research, algorithmic development, and sophisticated software production for the optimization of large-scale systems. The emphasis here was on theoretical research and algorithmic development for specially structured mathematical programming problems in the areas of complementarity theory and integer programming. Author (GRA)

N79-19737# Mitre Corp., Bedford, Mass.
SOFTWARE ACQUISITION MANAGEMENT GUIDEBOOK: REGULATIONS, SPECIFICATIONS, AND STANDARDS
J. B. Glore, M. P. Friedman, and S. M. Goheen Nov. 1978 216 p refs
(Contract F19628-78-C-0001)
(AD-A061793; MTR-3637; ESD-TR-78-178; ESD-TR-75-91)
Avail: NTIS HC A10/MF A01 CSCL 09/2

This is one of the ESD Software Acquisition Management (SAM) Guidebook series. It identifies and categorizes regulations, specifications, and standards (RSS) relevant to acquisition of software for Air Force systems. This volume is a major revision of ESD-TR-75-91 (MTR-3080), October 1975. It identifies the version of each document mentioned in the original RSS guidebook and still in effect when this revision was prepared. It also identifies the additional RSS referenced in the other SAM guidebooks plus many other documents considered pertinent. The material has been substantially reorganized and reformatted for easier

reference. For example, as an aid to retrieval by subject, the revision includes a Keyword in Context (KWIC) index of the titles and key title phrases of the relevant documents in effect when this revision was prepared. Author (GRA)

N79-19738# IBM Research Lab., Yorktown Heights, N. Y.
BEHAVIORAL STUDIES OF THE PROGRAMMING PROCESS Final Report, 1 May 1972 - 28 Feb. 1977
Lance A. Miller Oct. 1978 78 p
(Contract N00014-72-C-0419)
(AD-A061633) Avail: NTIS HC A04/MF A01 CSCL 09/2

This is a final report on an Office of Naval Research contract to investigate the behavioral problems and processes of computer programming. Following an overview of the effort given in section (1), the research work is discussed in sections (2)-(7) under six headings, with Motivation, Work Summary, and Recommendations given for each. Section headings are: (2) computer usage statistics; (3) performance with programming control structures; (4) natural language programming and communication; (5) investigation of program design behavior; (6) investigation of program modification behavior; and (7) general behavioral issues in interactive computer systems. The published reports, under the contract, are listed in section (8) with the contract personnel given in section (9). Author (GRA)

N79-19739# Computer Sciences Corp., El Segundo, Calif.
IMPROVEMENTS TO JOCIT Final Technical Report, Jul. 1976 - Mar. 1978
T. DeVine, L. Hyde, H. McCoy, and R. Rushall Griffiss AFB, N. Y. RADC Oct. 1978 50 p refs
(Contract F30602-76-C-0342)
(AD-A061714; RADC-TR-78-144) Avail: NTIS HC A04/MF A01 CSCL 09/2

Although the JOVIAL Compiler Implementation Tool (JOCIT) produced the most J3-like JOVIAL compiler built to date, the Air Force was not at liberty to develop compilers for other systems because of the proprietary nature of the JOCIT module, GENESIS. The intent of this effort was to lease GENESIS and to make various improvements to JOCIT. These improvements included fortifying the JOCIT optimizer with state-of-the-art optimizing features. For the most part, this effort accomplished the above, but resulted in the development of two separate optimizers. Additional improvements included optimizing the SYMPL compiler module of JOCIT and implementing an ASCII and floating point double precision data processing capability in the JOCIT produced compilers. Author (GRA)

N79-19740# Naval Surface Weapons Center, Dahlgren, Va.
SOLUTION OF THE INTEGER CONCAVE PROGRAM USING THE IC phi N ALGORITHM, VOLUME 2 Final Report
Harlan W. Loomis 1 Nov. 1978 135 p refs
(AD-A062012; NSWC/DL-TR-3120-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 12/2

The branch-and-bound technique has been the basis for algorithms to solve both the mixed integer linear program (having linear objective function, linear constraints, and integrality restrictions on some variables) and the concave nonlinear program (having a separable concave objective function and linear constraints). The subprograms for each of these branch-and-bound algorithms are linear programs with simple upper bounds. In Volume 1, a new branch-and-bound algorithm is presented for the composite mixed integer, concave nonlinear program. This integer concave (ICON) algorithm has been implemented in the form of a computer program coded in FORTRAN. A guide to the use of the computer program together with examples of its application are included in Volume 1. Documentation of the computer program is included in Volume 2. Author (GRA)

N79-19741# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
SURVEY OF SCOPE ISSUES IN PROGRAMMING LANGUAGES Interim Report
Bob Schwanke Jun. 1978 81 p refs
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A061977; CMU-CS-78-131; AFOSR-78-1493TR) Avail: NTIS HC A05/MF A01 CSCL 09/2

In this paper scope issues in programming languages, from the standard binding techniques and philosophies of early languages, to the recent work in data encapsulation is studied. First, the fundamental concepts of binding, then, their appearances in early languages is studied. The scope problems in these languages make clear the need for additional program structuring tools, leading to the development of data encapsulation mechanisms. The scope properties of data capsules, and comparisons with the encapsulation philosophies of several modern languages is also studied. The notion of abstract data types to study modern scope issues, and to survey recent advances in several scope-related areas is used. Finally, comparisons of the contrast of several languages, both old and new, is made by studying solutions in each of them to a common programming problem.
Author (GRA)

N79-19742# SRI International Corp., Menlo Park, Calif. Computer Science Lab.
THE SEMIAUTOMATIC GENERATION OF INDUCTIVE ASSERTIONS FOR PROVING PROGRAM CORRECTNESS Final Report, 1 Jul. 1977 - 30 Jun. 1978
Bernard Elspas and Robert F. Shostak Aug. 1978 116 p refs
(Contract F44620-73-C-0068; AF Proj. 2304; SRI Proj. 2686)
(AD-A061919; AFOSR-78-1491TR) Avail: NTIS HC A06/MF A01 CSCL 09/2

This final report describes progress over the period 1 July 1977 through 30 June 1978 on a five-year project aimed at the problem of synthesizing so-called inductive assertions to support the Floyd-Hoare method for proving correctness of computer programs. In the fifth year of research, reported here, concentration on using the Boyer-Moore system to prove several quite different kinds of programs is done. The first set of programs verified here form a system of LISP functions implementing a verification condition generator (VCG) for a simple block-structured language. The specifications for this VCG are given as standard Hoare axioms and rules. The second set of programs are algorithms for achieving synchronization among several clocks. This application arose in connection with the design of an operating system for a fault-tolerant avionics computer (SIFT) with hardware and software redundancy features. GRA

N79-19743# George Washington Univ., Washington, D. C. Inst. for Management Science and Engineering.
NONLINEAR PROGRAMMING GLOBAL OPTIMIZATION TECHNIQUES Final Report, 1 May 1973 - 30 Apr. 1978
James E. Falk, Anthony V. Fiacco, and Garth P. McCormick 1978 14 p refs
(Grant AF-AFOSR-2504-73)
(AD-A061895; AFOSR-78-1454TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

This report summarizes the results obtained in the area of optimization with non-convex functions. The difficulty is in determining when a local minimum is also a global minimum. The results can be classified into four areas: separable problems, factorable problems, infinitely constrained problems, and other specially structured problems. Author (GRA)

N79-19744# North Carolina Univ. at Chapel Hill.
SAMPLING FROM THE MULTINOMIAL DISTRIBUTION ON A COMPUTER
George S. Fishman Oct. 1978 32 p refs
(Contract N00014-76-C-0302)
(AD-A061651; TR-78-5) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes algorithms to effect multinomial sampling on a computer in ways that protect the sampler against an excess computing cost per sample. Section 2 presents the multinomial model together with an equivalent representation in terms of a series of binomial sampling experiments. The binomial representation is further discussed in Section 4. Sections 3 and 5 demonstrate the danger of using too simplistic a sampling scheme if execution time is a concern. Section 6 describes how a normal approximation to the binomial distribution can make execution time virtually independent of n. A criterion of acceptability is described. Section 7 describes an acceptance-rejection technique that, when used with a Poisson sample, allows the desired binomial sampling exactly. Using a normal approximation to the Poisson distribution, one can again generate multinomial samples virtually independent of n. Section 8 describes a procedure for binomial sampling based on the

inverse transform method. Section 9 describes the ordering of the serial binomial experiments in response to alternative objectives. Section 10 describes algorithm M3 which puts all the suggestions of earlier sections together. GRA

N79-19745# Rochester Univ., N. Y. Coll. of Engineering and Applied Science.
REPRESENTATIONS IN THE PADL-1.0/n PROCESSOR: THE DRAWING FILE (PADL/SD-14)
W. A. Hunt Jul. 1978 68 p refs
(Grants NSF GI-34274K)
(PB-288516/8; NSF/RA-780294) Avail: NTIS HC A04/MF A01 CSCL 09B

A Drawing File is a PADL standard representation of an engineering drawing; it serves as the interface between the PADL system's Graphic Output Generator and the specialized post-processor programs that drive particular plotters. A PADL-standard Drawing File is used to represent drawings produced by other systems. Drawing Files are defined as 'mathematical' representations which may be implemented for computational purposes in many different ways. The specific implementation used in the PADL-1.0/2.n system is described. S.E.S.

N79-19746# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
SIMULATION OF A MINIMUM DELAY DISTRIBUTED ROUTING ALGORITHM M.S. Thesis
John Christopher Poulos Jan. 1978 150 p refs
(Grant NSF ENG-76-24447)
(PB-288863/4; ESL-R-795) Avail: NTIS HC A07/MF A01 CSCL 09B

A quasi-static distributed routing algorithm for computer networks is presented. The algorithm seeks to minimize the total expected message delay in the network by successively changing the routing variables (fractions of traffic of a given commodity on a link) until the optimum routing is achieved. A simulation program for this algorithm is developed. The concepts of single vs. multiple eta's, and of fixed vs. dynamic eta's are investigated. A scheme, using a single (global) dynamic eta, is based on the use of a line search at each iteration, common in iterative optimization algorithms, and displays some very favorable properties, namely, fairly rapid convergence for light to moderate loads, and virtual independence from any arbitrary scale factor. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N79-19747 North Carolina Univ. at Chapel Hill.
MODELS OF MULTIPROCESSING FOR TRANSACTION-ORIENTED COMPUTER SYSTEMS Ph.D. Thesis
Frank Donelson Smith, Jr. 1978 407 p
Avail: Univ. Microfilms Order No. 7900505

Multiprocessing can be used effectively in computer systems which process transactions. Blaauw's distinction among computer architecture, implementation, and realization is used in creating models which relate performance to the equipment used in a processor. With these models the computer architecture is held constant (System/360) and three implementations are studied (360/40, 360/50, and 360/65). Implementation-dependent but realization-independent measures are used to eliminate technology differences. Performance is measured in instructions per datapath beat (I/B); equipment is measured in circuits and bits. Dissert. Abstr.

N79-19748 California Univ., Los Angeles.
NETWORK JOB CONTROL: THE TOWER OF BABEL REVISED Ph.D. Thesis
Terence Eugene Gray 1978 530 p
Avail: Univ. Microfilms Order No. 7906171

The problems associated with allocating resources and executing programs in a heterogeneous computer network are explored. A simple conceptual model of network resources is offered as a basis for network command language design. A Machine Independent Resource Allocation and Control Language (MIRACLE) is proposed. MIRACLE is an expression oriented, event-driven language for managing the execution of concurrent tasks. It is also an algorithmic language with flexible data structures and extensibility, which would be suitable for developing more sophisticated user interfaces. MIRACLE combines an extremely simple syntax for invoking pre-defined functions with the ability to abbreviate frequently used command lines and to define arbitrarily complex procedures and macros. Dissert. Abstr.

N79-19749 Purdue Univ., Lafayette, Ind.
COMMUNICATION IN COMPUTER NETWORKS: TIME DELAY AND DATA RATE PERFORMANCE MODELLING Ph.D. Thesis
Ignas G. Niemegeers 1978 244 p
Avail: Univ. Microfilms Order No. 7905758

Analytical models to evaluate these two performance parameters for a logical link in a sample network configuration in which the network nodes and the host computers are the same are developed. A model for the network nodes is proposed in the form of a priority queueing system, which can evaluate message time delays as a function of the workload. To study the effects of the network traffic on delay times of single messages, a queueing network model is developed. A similar, but analytically simpler model, is proposed for analyzing the effects of the network traffic on the maximum data rate of a logical link. Dissert. Abstr.

N79-19750 Massachusetts Univ., Amherst.
MULTIPROCESSOR SCHEDULING WITH DYNAMIC REASSIGNMENT Ph.D. Thesis
Shahid Hussain Bokhari 1978 121 p
Avail: Univ. Microfilms Order No. 7901978

A mathematical model to permit relocation of a module from one processor to the other during the course of program execution was developed. A solution to the problem of finding the optimal assignment for the restricted class of programs in which the intercommunication pattern of the modules is tree-like is described. This problem is solved by first drawing up an assignment graph in which every tree that satisfies certain properties corresponds to an assignment of modules to processors. The length of this tree gives the cost of the corresponding assignment. The optimal assignment corresponds to the shortest length tree. A dynamic programming approach is presented that efficiently finds the shortest tree in an assignment graph for any arbitrary number of modules and processors. Dissert. Abstr.

N79-19751# Tesseract Corp., San Francisco, Calif. Inst. for Computer Science and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: GUIDELINE ON MAJOR JOB ACCOUNTING SYSTEMS: THE SYSTEM MANAGEMENT FACILITIES (SMF) FOR IBM SYSTEMS UNDER OS/MVT
Gary Durbin, Todd Kinney, Peter Lamasney, Edward Newman, and Edward Syrett Oct. 1978 196 p
(PB-289129/9; NBS-SP-500-40) Avail: NTIS HC A09/MF A01 CSCL 09B

The need for a better understanding of how job accounting systems work, what they measure, and how accurately they measure was studied. The accounting system described is IBM's System Management Facilities (SMF) for 360/370 environments operating under OS/MVT. Considerable detail is provided on SMF's activity in collecting the data necessary to account for resources used by the individual jobs in a multiprogramming system and to provide some indicators of the performance of the system itself. The accuracy, both absolute and relative, of SMF as a measurement tool and the costs entailed in the use of SMF was investigated. The experimental methodology used to explore these questions is summarized. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N79-19752 State Univ. of New York at Buffalo.
AN ALGORITHM FOR BUDGET ALLOCATION, PRICING RECHARGE AND ADAPTIVE CONTROL FOR COMPUTER RESOURCES Ph.D. Thesis
Edward Lewis 1978 598 p
Avail: Univ. Microfilms Order No. 7905289

Allocating funds to users for the use of a computing resource and the pricing of that resource is a potential problem faced by any organization having a computer. Budget allocation and recharge are not independent processes but parts of a balanced system designed to afford each user the quantity and quality of service desired at affordable prices. Although both the allocation and pricing can be accomplished independently the former by users or budget committees and the latter by the computing center, these processes are rarely merged into a balanced system which guarantees equitable treatment of users, total cost recapture and quality control. The literature indicates that there are a number of common problems concerning allocation and recharge of computing resources. Some of the major concerns are listed and are considered in detail. Dissert. Abstr.

N79-19753 Stanford Univ., Calif.
MATHEMATICAL PROGRAMMING APPLICATIONS IN PATTERN RECOGNITION Ph.D. Thesis
Robert Hemstreet Leary 1978 126 p
Avail: Univ. Microfilms Order No. 7905894

Problems in pattern recognition are treated by the methods of mathematical programming. In particular, the two-class pattern classification model with decision rules based on discriminant functions is considered with emphasis on mathematical programs that determine linear and piecewise linear discriminants. For linearly separable pattern sets a separating hyperplane can determined by solving a system of linear inequalities. This system serves as the constraint set for a class of mathematical programs that defines separating linear discriminants exhibiting maximum tolerance to pattern noise. Specific cases that can be modelled as linear and quadratic programs are discussed and a reliability interpretation of the objective criterion is given. Dissert. Abstr.

N79-19754 Dayton Univ., Ohio.
A NEW METHOD FOR ANALYSIS OF NONLINEAR CONTROL SYSTEMS Ph.D. Thesis
Paul Bernard Knese 1978 147 p
Avail: Univ. Microfilms Order No. 7904244

A method is presented for the rapid analysis of both linear and nonlinear control systems based on the Tustin transformation for linear systems. Linear systems were analyzed with the method which produced extremely accurate results. Nonlinear systems were analyzed by examining specific cases, which included systems governed by Rayleigh's equation, van der Pol's equation and the Lewis servomechanism. Control systems containing hysteresis in both the forward and the feedback loops were analyzed as examples. The method applies to systems governed by ordinary differential equations and which may contain highly nonlinear terms and elements. The solutions lag the inputs by one-half the sampling period, but the simplicity of the method permits significantly increased sample rates suitable for real-time simulation. Dissert. Abstr.

N79-19755 Tennessee Univ., Knoxville.
APPLICATION OF TREE LANGUAGES TO PATTERN RECOGNITION Ph.D. Thesis
Alejandro Barrero 1978 102 p
Avail: Univ. Microfilms Order No. 7903399

Techniques in the theory of tree languages for applications in syntactic pattern recognition is developed. A procedure is presented for the inference of tree grammars which is more general than existing methods. The minimization of tree automata is considered where a source of errors in the conventional approach is uncovered, and the method is modified to correct this problem. The recognition of imperfect patterns is studied. The approach used to recognize imperfect patterns is based on an extension of tree languages to include trees specified by error operators. Dissert. Abstr.

N79-19756 California Univ., Berkeley.
TANTEM QUEUEING SYSTEMS WITH BLOCKING Ph.D. Thesis
Eswarahalli Sundararajan Dattatreya 1978 84 p
Avail: Univ. Microfilms Order No. 7904415

Blocking systems are queueing systems of several service stations in series, with finite waiting room at each station. Customers are blocked on completion of service at any station if the queue at the next station is full. Blocking systems are shown in which service stations consisting of single servers are reversible, i.e., the capacity does not change when the order of the service stations is reversed. This property holds even if the service times of the same customer at the different stations are dependent. By making the additional assumption of the independence of these service times, this result is extended to systems with multi-server stations and to certain queueing networks. Exponential systems and loss systems are also considered. Dissert. Abstr.

N79-19757 Northeastern Univ., Boston, Mass.
SOME RESULTS ON CYCLIC ARITHMETIC CODES Ph.D. Thesis
Wen Yung Yeh 1978 106 p
Avail: Univ. Microfilms Order No. 7904170

Consideration is given to the arithematic codes, denoted as AN codes, which are different from the more familiar algebraic codes in that all operations are ordinary arithmetic. These codes can be used for error control in data transmission and in computation. Appropriate cyclotomic numbers of (r to the nth power-1) to form the generator A of single error correcting codes were selected. Decoding algorithm for multiple independent random-correcting cyclic AN codes with less computation and less memory storage than existing algorithms are presented. Four methods of random errors decoding algorithm were developed. They are (1) error-trapping, (2) modified error-trapping, (3) permutation decoding, and (4) correlation decoding. Decoding algorithm for linear cyclic AN codes used in single-burst-error-correction were investigated. Methods of burst-error decoding procedures are discussed. Dissert. Abstr.

N79-19758# Maryland Univ., College Park. Computer Science Center.
METRICATION ERRORS AND CODING EFFICIENCY OF CHAIN-ENCODING SCHEMES FOR THE REPRESENTATION OF LINES AND EDGES Interim Report
D. Rosen and D. Proffitt Sep. 1978 26 p refs
(Grant AF-AFOSR-3271-77)
(AD-A062034; CSC-TR-696; AFOSR-78-1504TR) Avail: NTIS HC A03/MF A01 CSCL 20/6

Errors associated with several boundary encoding schemes are discussed in terms of average errors encountered when using the schemes directly for measurement of the lengths of arbitrarily directed straight lines. Ways in which the measurement errors may be diminished are examined; the simplest is to make an allowance for the number of corners that appear when a line is represented by a 4-way code. The efficiencies of the various coding schemes are examined and the 4-way code is found to be the most efficient of the close-neighbors coding schemes, although efficiency can be further increased by use of a generalized code. Author (GRA)

N79-19759# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
CONTROL OF DYNAMICAL SYSTEMS Annual Progress Report, 1 Sep. 1977 - 31 Aug. 1978
H. T. Banks 22 Oct. 1978 39 p refs
(Grant AF-AFOSR-3092-76)
(AD-A062020; AFOSR-78-1478TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Twenty publications were prepared or published during this year of research. The areas of research include developing numerical methods for control and identification of delay systems, optimal control of diffusion-reaction systems, qualitative theory for delay systems, theory for nonlinear oscillations and bifurcation, and stability conditions for discrete control systems. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-19760 Cincinnati Univ., Ohio.
DIAKOPTICS AND GENERALIZED LARGE SCALE EIGENVALUE PROBLEM Ph.D. Thesis
Surinder Kumar Ram 1977 226 p
Avail: Univ. Microfilms Order No. 7905168

Considerable ease in the formulation of characteristic equation of the eigenvalues of the system is entailed by the application of diakoptics to the simulated electric network model of any linear large scale system, described by a set of ordinary differential equations of first degree and any order. Diakoptics coupled with appropriately chosen algorithm for the iterative solution of the characteristic equation results in significant computational economy as compared to nondiakoptical methods. New diakoptical methods have been developed for the solution of generalized eigenvalue problem of first order both for the symmetric and asymmetric cases. The higher order linear system, comprehensive diakoptical solution of linear electric network model, representing any electrical or nonelectrical system is presented. Dissert. Abstr.

N79-19761 California Univ., Berkeley.
ON THE SEMI-GROUP OF EFFECTIVE DIVISOR CLASSES OF AN ALGEBRAIC VARIETY: THE QUESTION OF FINITE GENERATION Ph.D. Thesis
Jeffrey Arthur Rosoff 1978 97 p
Avail: Univ. Microfilms Order No. 7904586

On a non singular variety X over an algebraically closed field, the group of algebraic cycles of codimension one modulo algebraic equivalence (=homological equivalence if the ground field is the field of complex numbers) is considered. It is known that this group, the Neron-Severi group of X, is a finitely generated Abelian group, and upper bounds on the number of generators are known. An element of this group is called effective if it can be represented by a formal sum of subvarieties of codimension one with non negative coefficients; the set of effective elements forms a semi-group M(X) in the Neron-Severi group. Examples of surfaces of various types in the standard classification scheme for which M(X) is finitely generated are constructed, as well as examples for which finite generation fails. Dissert. Abstr.

N79-19762 Wisconsin Univ. - Milwaukee.
DEVELOPMENT OF A SECOND ORDER APPROXIMATION FOR THE NAVIER-STOKES EQUATIONS Ph.D. Thesis
William Albert Shay 1978 109 p
Avail: Univ. Microfilms Order No. 7905050

The development of a second order numerical method to solve the Navier-Stokes equations governing fluid flowing in a closed cavity for large values of the Reynolds number was studied. Both the driven cavity problem and the heated cavity problem are examined. For small Reynolds numbers, there is excellent agreement among the results of different second order methods. A comparison with Greenspan's upwind method is also made to demonstrate the superiority of the second order method. To determine the viability of this method, it is applied to the heated cavity problem. Converged solutions were obtained for all Prandtl numbers and Rayleigh numbers tested. Level curves of the stream, vorticity, and temperature functions are given for the cases of Rayleigh number 20000, Prandtl number .73, and Rayleigh number 100, Prandtl number .0001. Dissert. Abstr.

N79-19763 Stanford Univ., Calif.
HEIGHT ESTIMATES FOR CAPILLARY SURFACES Ph.D. Thesis
David Siegel 1978 87 p
Avail: Univ. Microfilms Order No. 7905928

The height function is the solution to a nonlinear elliptic boundary value problem in a domain in n-dimensional Euclidean space. Estimates are obtained when the domain is a ball or the complement of a ball. Estimates for the height at the boundary are given which improve upon estimates. For a small or large ball, Laplace's formulas for the center height are shown to be asymptotically correct. For a small ball, the solution is shown to be close to a spherical cap. For the complement of a ball, the solution is shown to behave like a decaying solution to the linearized equation, far from the center of the ball. Solutions in unsymmetrical domains are estimated in terms of solutions in symmetric domains, by use of a comparison principle due. As an application, solutions in a two-dimensional sector are studied. The solution is proved to be unique and estimates on the boundary height are given. Dissert. Abstr.

N79-19764 Brown Univ., Providence, R. I.
TWO APPLICATIONS OF THE INVARIANCE PRINCIPLE TO PARABOLIC EQUATIONS Ph.D. Thesis
Nicholas Dimitrios Alikakos 1978 105 p
Avail: Univ. Microfilms Order No. 7906512

Two parabolic problems are considered in this paper. In Part 1 the equation u sub t = u sub xx, u sub x(i,t) = (-1) to the i power f(u(i,t)), i = 0,1 (0 < x < 1, t> 0 is studied. Under suitable conditions on the nonlinearity global existence, uniqueness and compactness of the orbits is established. In Part 2 a particular case of the problem to be studied is the system theta c sub i/theta t = v sub i Delta c sub i + B sub i (c sub i,...,c sub N), theta c sub i/theta sub n divided by theta Omega = 0, i = 1,...,N v sub i >0, Omega open, smooth, bounded in IR to the nth power. In both problems the concept of the dynamic system (Nonlinear Semigroup) plays a crucial role. The key tool for the investigation of the asymptotic behavior is the Invariance Principle. Dissert. Abstr.

N79-19765 Stanford Univ., Calif.
THE CONSTRUCTION OF INITIAL DATA FOR HYPERBOLIC SYSTEMS FROM NONSTANDARD DATA Ph.D. Thesis
Kenneth Paul Bube 1978 118 p
Avail: Univ. Microfilms Order No. 7905823

First order systems of hyperbolic partial differential equations with periodic boundary conditions in the space variables are studied which complete initial data, are not available. It is supposed that the first j components of a solution u of the system can be measured, perhaps with their time derivatives, but cannot measure the rest of the components of u completely and accurately at any time level. Such problems arise in geophysics. The effect of the Coriolis term in the linearized shallow water equations on the possibility of recovering the wind fields from the geopotential height is examined. Algorithms and computational results are presented for a model two-by-two system. The method of intermittent updating currently being used in numerical weather prediction is also examined as a method for the assimulation of data. Dissert. Abstr.

N79-19766 Brown Univ., Providence, R. I.
THE APPLICATION OF THE GENERALIZED INVERSE TO INTERPOLATION THEORY Ph.D. Thesis
Rosemary Elizabeth Chang 1978 106 p
Avail: Univ. Microfilms Order No. 7906528

The Moore-Penrose theory provides a generalized inverse for every matrix, square or rectangular, having properties of the usual inverse. With this tool, any linear system can be 'solved' in a certain external sense. Interpolation theory provides an interesting application for the generalized inverse. The applicability of the generalized inverse to the solution of a broad class of interpolation problems is studied. A progression of problems is studied commencing with simple polynomial interpolation and culminating with an infinite interpolation problem in the Hardy space, H-2. Dissert. Abstr.

N79-19767 Stanford Univ., Calif.
UPPER BOUNDS FOR THE FIRST EIGENVALUE OF THE LAPLACE-BELTRAMI OPERATOR AND AN ISOPERIMETRIC INEQUALITY FOR LINKED SPHERES Ph.D. Thesis
Michael Eaton Gage 1978 83 p
Avail: Univ. Microfilms Order No. 7905864

Upper bounds are obtained for the first eigenvalue of the Laplace-Beltrami operator in a geodesic disk or annulus of a differentiable manifold in terms of a lower bound on the Ricci curvature in that region. A comparison theorem and a numerical estimate are presented. In two dimensions a lower bound on the average Gauss curvature on each geodesic circle is sufficient to obtain the result. The methods of integral geometry are used to prove that a set diffeomorphic to a two-sphere which is

linked in four dimensional Euclidean space with a closed curve must have area greater than that of a standard two-sphere whose radius is the distance between the two sets. New proofs for the analogous result for two linked curves in three dimensional space are also given. Dissert. Abstr.

N79-19768 California Univ., Berkeley.
CONVEX CURVES AND CONIC SECTIONS Ph.D. Thesis
Michael Thomas Palmiter 1978 149 p
Avail: Univ. Microfilms Order No. 7904569

Evidence of a deeper relation between convex bodies and conic sections is developed. Bounded convex bodies all possess a pair of interior points termed foci, which generalizes the motion of a pair of foci of an ellipse. Uniqueness of foci is proved for convex bodies symmetric with respect to some point. In the course of proving these results, there arises the concept of points lying opposite to one another within a convex body, there existing a unique point, the delta center, which is opposite to itself. Based on this concept, a natural measure of (central) symmetry for a convex body is found. The attempt to include the parabolic and hyperbolic cases in this scheme has yielded partial results which are presented in an appendix; there a convex curve is seen as the real portion of a more extensive geometric structure in the complex projective plane, this structure being called a quasialgebraic curve. Quasi-algebraic curves of order n = 2 correspond roughly to the three types of convex body.
Dissert. Abstr.

N79-19769 California Univ., Berkeley.
DECREASING SUBSEQUENCES OF RANDOM PERMUTATIONS Ph.D. Thesis
Shaiy Pilpel 1978 55 p
Avail: Univ. Microfilms Order No. 7904577

The optimal stopping time procedure necessary to obtain a decreasing subsequence of an unknown permutation of the numbers 1,....,n observed sequentially is considered. Optimality is measured as maximizing the expected length of the chosen decreasing subsequence. Also, the case when the distribution of random variables X sub 1,..., X sub n is unknown is also solved. Related theorems are solved. Dissert. Abstr.

N79-19770 California Univ., Davis.
NONPARAMETRIC ESTIMATION OF WEIGHTS IN LEAST-SQUARES REGRESSION ANALYSIS Ph.D. Thesis
Robin Lawrence Rose 1978 84 p
Avail: Univ. Microfilms Order No. 7905205

It is shown that the kernel approach can be used to obtain uniform strongly consistent estimates of the weights for the least squares problem. Attention is then given to weighted linear least squares estimation which makes use of estimates of the weights. Such least squares estimators are first shown to be strongly consistent. There follows a discussion of the asymptotic distribution theory for the weighted least squares estimators. Finally, a computer simulation compares the performance of least squares estimates using several different weighting schemes. Nonlinear weighted least squares is studied next. Building on some preliminary results, strong consistency is shown for least squares parameter estimates which are computed using estimated weights. The specific example of binary response logistic regression is then studied. It is found that kernel estimates of the weights together with the logit transformation change the nonlinear minimization problem into a linear one and that the transformed problem still yields strongly consistent parameter estimates.
Dissert. Abstr.

N79-19771 Johns Hopkins Univ., Baltimore, Md.
TRANSFER FUNCTION METHODS FOR NONLINEAR DISCRETE-TIME SYSTEMS Ph.D. Thesis
Steven John Clancy 1979 121 p
Avail: Univ. Microfilms Order No. 7906441

A transfer function representation which differs from previously used representations for scalar input-scalar output, homogeneous, nonlinear, discrete-time systems is shown to provide simple input-output calculation, realization, and identification procedures. The results generalize standard linear system results in a particularly nice manner. Dissert. Abstr.

N79-19772 Missouri Univ. -Rolla.
A THREE-DIMENSIONAL ANALYSIS OF EXTRUSION AND METAL FORMING BY THE FINITE ELEMENT METHOD Ph.D. Thesis
William Donald Webster, Jr. 1978 99 p
Avail: Univ. Microfilms Order No. 7904338

A finite element approach is used to analyze extrusion and certain order metal forming problems by adapting an optimization method to the Upper Bound Theorem. The technique is applicable to any general shape problem since the 20 node finite element used allows for curved boundaries. This higher order element allows velocities to be approximated as cubics. Techniques developed through the use of this higher order element make it possible to calculate the changes in temperature, strain rate, strain, and hydrostatic pressure throughout the deformation regions of the material. The effects of these changes are incorporated through the use of a non-linear stress-strain curve. An 8 node slip element is developed in order to model the effects of friction. The slip element is capable of analyzing coulomb friction, constant shear friction, and hydrodynamic lubrication.
Dissert. Abstr.

N79-19773*# North Carolina State Univ., Raleigh.
NUMERICAL METHODS FOR PROBLEMS INVOLVING THE DRAZIN INVERSE Final Report, 1 Jun. 1978 - 1 Oct. 1978
Carl D. Meyer, Jr. 27 Mar. 1979 8 p
(Grant NsG-1532)
(NASA-CR-158233) Avail: NTIS HC A02/MF A01 CSCL 12A

The objective was to try to develop a useful numerical algorithm for the Drazin inverse and to analyze the numerical aspects of the applications of the Drazin inverse relating to the study of homogeneous Markov chains and systems of linear differential equations with singular coefficient matrices. It is felt that all objectives were accomplished with a measurable degree of success. L.S.

N79-19774# Academic Computer Center, Utrecht (Netherlands).
FAST INTERACTIVE METHODS FOR LARGE LINEAR SYSTEMS Final Technical Report
Henk A. Vandervorst Aug. 1978 115 p
(Grant DA-ERO-75-G-0084)
(AD-A061729) Avail: NTIS HC A06/MF A01 CSCL 12/1

In reference 1 of the report, special splittings of the matrix of a sparse linear system were proposed. These splittings can be combined with the conjugate gradients method, which results in very efficient iterative solutions methods when the matrix is a symmetric M-matrix. The research reported in this Final Technical Report has been focused on three major subjects: a systematic overview of possible splittings for several types of matrices and eigenvalue information; applications to nonsymmetric linear systems; and solution of generalized eigenvalue problems for sparse linear systems. GRA

N79-19775# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
APPROXIMATION OF DELAY SYSTEMS WITH APPLICATIONS TO CONTROL AND IDENTIFICATION Interim Report
H. T. Banks Jul. 1978 15 p refs Presented at the Conf. on FDE and Approximation of Fixed Points, Bonn. Univ. (Germany), 16-22 Jul. 1978
(Grants AF-AFOSR-3092-76; NSF MCS-78-18858; AF Proj. 2304)
(AD-A062067; AFOSR-78-1511TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We discuss approximation ideas for functional differential equations and how these ideas can be employed in optimal control and parameter estimation problems. Two specific schemes are described, one based on integral averages of the function being approximated, the other based on best L2 spline approximations. An example illustrating numerical behavior of these schemes applied to an optimal control problem is presented.
Author (GRA)

N79-19776# White Sands Missile Range, N.Mex. Instrumentation Directorate.

FREQUENCY RESPONSE OF ALPHA-BETA-GAMMA TRACKERS Final Report
J. E. Steelman Sep. 1978 27 p refs
(DA Proj. 1T6-65804-D-E93)
(AD-A062001; STEWS-ID-78-3) Avail: NTIS HC A03/MF A01 CSCL 17/7

The alpha-beta-gamma tracking equations are written in compact form and then Z transformed. The resulting expressions for estimated position, estimated velocity, estimated acceleration, and predicted position are in terms of the measured position and Z (the Z transform variable). These equations are first solved for the ratio of output (an estimated or predicted quantity) to input (the measured position) and then Z is replaced by exp(-j (omega) T) (omega is the radian frequency and T is the sample interval). After this change, the magnitude and phase for various output-input ratios is plotted as a function of omega T. Linear plots and Bode plots (especially useful for real-time control system design) are presented. Equations are given for the frequency at which the output is 0.707 of the input, for the minimum of the output to input ratio and for the overshoot (amount by which the output exceeds the input). A synopsis of previously available statistical properties of alpha-beta-gamma trackers is also included. Author (GRA)

N79-19777# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.
COMBINATORIAL TOPOLOGY AND TRADE OFF METHOD IN BIB DESIGNS Interim Report
A. Hedayat and Shuo-Yen Robert Li Jul. 1978 24 p refs Presented at the Intern. Symp. on Combinatorial Math. and Optimal Design, Colorado State Univ., 5-9 Jun. 1978
(Grants AF-AFOSR-3050-76; NSF MCS-77-03533)
(AD-A061926; AFOSR-78-1457TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

When two BIB designs based on the same set of varieties have identical parameters, one can obtain either of them from the other by trading off some blocks for an equal number of blocks. Define a trade to be two collections of blocks such that each of the (v/2) pairs of varieties is contained in the same number of blocks from both collections. A method, based on combinatorial topology, for studying the trades with block size 3 is introduced. Using this method it is proven that the volume of a trade can never be 5. Also we present a simple topological proof of the existence of a unique type of minimal trades, into which every trade can be decomposed. GRA

N79-19778# Missouri Univ. - Columbia. Dept. of Mathematics.
ORDINARY DIFFERENTIAL EQUATIONS: OSCILLATION AND STABILITY THEORY Final Report, 15 Apr. 1976 - 31 Aug. 1978
Walter Leighton 6 Nov. 1978 6 p refs
(Grant DAAG29-76-G-0206)
(AD-A061891; ARO-13610.4-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Appreciably larger domains of attraction were found for asymptotically stable equilibrium points of equations of the form x(double dot) - beta(x(dot)) f(x) = 0; a generalization of a classical result for orthogonal polynomials was obtained; a new comparison theorem for conjugate points of equations (r(x)y) p(x)y = 0 is given; the last yields a comparison theorem for the minimax function. Author (GRA)

N79-19779# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.
THE TRADE OFF METHOD IN THE CONSTRUCTION OF BIB DESIGNS WITH VARIABLE SUPPORT SIZES Interim Report
A. Heydayat and Shuo-Yen Robert Li Feb. 1978 28 p refs (Grants AF-AFOSR-3050-76; NSF MCS-77-03533; AF Proj. 2304)
(AD-A061925; AFOSR-78-1458TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A balanced incomplete block (BIB) design with b blocks is said to have the support size b^* when exactly b^* of the b blocks are distinct. BIB designs with b^* b have interesting applications in design of experiments and controlled sampling. A method called trade off is introduced for the construction of BIB designs with repeated blocks. This method is utilized to study BIB designs with arbitrary v treatments with blocks of size k = 3 in general and with v = 7 and k = 3 in particular. It is shown that BIB designs with v = 7, k = 3, and b, and any b^* exist if and only if b is divisible by 7; 7 = or < b^* = or < min (b,35); b^* not equal 8, 9, 10, 12, or 16; (b,b^*) not equal (28,24), (28,27), (35,30), (35,32), (35,33), (35,34), or (42,34). GRA

N79-19780# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.
SOME BOUNDS ON BALANCED BLOCK DESIGNS Interim Report
Sanpei Kageyama Mar. 1978 27 p refs
(Grant AF-AFOSR-3050A-76)
(AD-A061927; AFOSR-78-1456TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Bounds on the latent root of the C-matrix and the number of blocks for a variance-balanced block design are given. These results include the well known results as special cases. Author (GRA)

N79-19781# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
JUMP-DIFFUSION APPROXIMATIONS FOR ORDINARY DIFFERENTIAL EQUATIONS WITH WIDE-BAND RANDOM RIGHT HAND SIDES
Harold J. Kushner Sep. 1978 40 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-76; NSF ENG-73-03846)
(AD-A061950; LCDS-78-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let $Y^{(\epsilon)}$ be a stationary mixing process and J superscript epsilon ($^{(\epsilon)}$) an approximation to a random impulsive process. Kurtz's results on approximation of a general semigroup by a Markov semigroup are used to prove (weak and a similar type of) convergence of the solutions to (1.1) and to jumping diffusions. Previous results are generalized in various ways. The case of unbounded $y^{(\epsilon)}$ is also treated as is the combined jump-diffusion case. Also, a limit theorem for an integral with respect to approximate white noise in terms of an Ito integral is given. The method has the advantages of generality and relative ease of use. Author (GRA)

N79-19782# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
CERTAINTY EQUIVALENT SOLUTIONS OF QUADRATIC TEAM PROBLEMS BY A DECENTRALIZED INNOVATIONS APPROACH
Steven M. Barta and Nils R. Sandell, Jr. Feb. 1978 39 p refs
(Contract E(49-18)-2087)
(PB-288861/8; ESL-P-799) Avail: NTIS HC A03/MF A01 CSCL 12A

A team decision problem with a quadratic loss function is considered. It is shown that the optimal solution satisfies a certainty equivalence type separation theorem. When the state and the agents' information variables are continuous-time stochastic processes, the solution to the estimation part of the decision rule is characterized by an integral equation. By introducing a decentralized innovations process, this equation is solved. If the state is generated by a finite-dimensional linear system and each agent has a (possibly) distinct linear noise corrupted observation of the state, then the optimal decision rules are generated recursively from a decentralized linear filter. A second-guessing paradox is resolved. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-19783 Purdue Univ., Lafayette, Ind.
SOME QUEUES INVOLVING PHASE TYPE PROBABILITY DISTRIBUTIONS Ph.D. Thesis
Ramasuami Vaidyanathan 1978 147 p
Avail: Univ. Microfilms Order No. 7905786

A single server queue whose input is the versatile Markovian point process is discussed, herein to be called the N-process. Special cases of the N-process include a number of complex models such as the Markov-modulated Poisson process, the superposition of a Poisson process and a phase type renewal process etc. Infinite server queues whose input is a phase renewal process were also discussed. The problems of obtaining the transient and steady-state distributions and moments of the queue length are reduced to the solution of certain well-behaved systems of linear differential equations. Dissert. Abstr.

N79-19784 California Univ., Berkeley.
RANDOMIZED RESPONSE MODEL WITH MORE THAN TWO CHOICES Ph.D. Thesis
Jonathan Chukwuemeka Nkwuo 1978 118 p
Avail: Univ. Microfilms Order No. 7904561

This work is concerned with survey designs to eliminate this evasive answer bias when estimating the proportion of persons in the population with the sensitive characteristic. A fairly comprehensive survey of the literature is presented on the theory of randomized response design from its inception to the present state of the art. A new randomized response design with more than two responses is introduced. Using Fisher's information measure, the optimal choice of design probabilities for this model is indicated. The model is generalized to estimate more than two proportions using a single sample and an indication is given also on the choice of design probabilities. The optimized model with two answers is shown to be most efficient. It is demonstrated that there are situations where a model with three answers is likely to induce the same level of cooperation as a certain two-answer design but is indeed more informative as measured by the value of the Fisher information. Dissert. Abstr.

N79-19785 Purdue Univ., Lafayette, Ind.
SOME BEST CHOICE PROBLEMS WITH PARTIAL INFORMATION Ph.D. Thesis
Joseph David Petruccelli 1978 106 p
Avail: Univ. Microfilms Order No. 7905762

Variations of the secretary problem are examined. The problem considered involves a family of continuous distribution functions and observations taken sequentially with the object of selecting the largest observation. At time j the jth observation must be chosen (and the process terminated) or rejected (and the process continued). No knowledge of the future is allowed, no recall of rejected observations is possible and one observation must be selected. Versions of this problem obtained when the family is all distribution functions, a single distribution function, and any family distinct from these are denoted as the no information, full information, and partial information best choice problem. The partial information problem is investigated for the location, scale, or location-scale parameter family of distribution and the family of all normal distributions. Dissert. Abstr.

N79-19786 Cincinnati Univ., Ohio.
MULTIDIMENSIONAL SCALING IN HILBERT SPACES: REPRESENTATION AND DISCRETIZATION Ph.D. Thesis
Son Pham 1978 143 p
Avail: Univ. Microfilms Order No. 7904761

Given a triple (X, delta,mu), where X is a measurable space, mu a finite positive measure on X and delta a square summable quasimetric on X, the following results established: (1) The space X is representable by some cloud in sq lambda equipped with a quadratic form preserving the quasi-distances almost everywhere. The coordinates of the elements in the cloud are given explicitly in terms of the eigenvalues and the eigenvectors of a certain Hilbert-Schmidt operator. (2) Necessary and sufficient conditions to represent the triple(X,delta,mu) in a Hilbert space are given. (3) The dimension of the triple (X,delta, mu) is defined. (4) If the quadratic form on sq lambda is positive semi-definite, then the best fitting axes by means of weighted least-squares, of the representing cloud are given. Approximate representations of the triple (X,delta, mu) can be obtained by the representations of (X sub n, delta sub n, mu sub n) constructed by the Nystrom method. Dissert. Abstr.

N79-19787 Purdue Univ., Lafayette, Ind.
ASYMPTOTIC DESIGN AND ESTIMATION IN POLYNOMIAL SPLINE REGRESSION Ph.D. Thesis
Girdhar Gopal Agarwal 1978 147 p
Avail: Univ. Microfilms Order No. 7905692

An algorithm is presented, which exploits these theoretical results, in an attempt to sequentially estimate a function by linear spline function. The algorithm is presented in such a way that the explicit knowledge of the function is not required. Finally, two numerical examples are done to illustrate the behavior of this algorithm. Dissert. Abstr.

N79-19788 Pittsburgh Univ., Pa.
THE REDUCTION OF SUM OF ERRORS OF BETA FOR AGGREGATE DATA Ph.D. Thesis
Bernard Leonard Zakrzewski 1978 153 p
Avail: Univ. Microfilms Order No. 7902733

In any analysis of aggregation the researcher must work with quantitative measures of aggregation loss and establish some norms for interpreting them. A common statistical framework for comparing different alternative estimation procedures emphasizes comparison of the sampling distribution for the alternative procedures. The particular interest of this paper was the examination of bias using least Squares and Principal Component estimators as it is applied to the multiple regression case. The criteria of comparison was the sum of errors of beta, SEB. Population of size N = 10,000 with 5, 10, and 15 independent variables were generated with average intercorrelation of 0.2, 0.5 and 0.8. To investigate the reduction of SEB aggregate data, 5%, 15% and 20% samples were drawn from the populations. Two aggregation techniques were used. Dissert. Abstr.

N79-19789 Missouri Univ. -Rolla.
INTERFERENCE ON THE SHAPE PARAMETER OF THE GAMMA DISTRIBUTION AND CRAMER-RAO LOWER BOUNDS FROM CENSORED DATA Ph.D. Thesis
James Joseph Wyckoff 1978 88 p
Avail: Univ. Microfilms Order No. 7904335

The first article considers inferential procedures on the shape parameter of a gamma distribution from censored sampling. Moments for the statistic T = log-(X bar sub r/ X similar to sub r) are found and used to derive a two-moment chi-square approximation for T. This approximation is then used for testing, estimating, and setting confidence bounds on the shape parameter of a gamma distribution. The second article concerns the Cramer-Rao lower bounds for the variances of estimators, where the estimators are based on censored data. Convenient techniques are derived to evaluate the lower bounds in the presence or absence of nuisance parameters. Dissert. Abstr.

N79-19790 Clemson Univ., S.C.
A DISCUSSION OF RIDGE REGRESSION ANALYSIS AND ITS APPLICATIONS Ph.D. Thesis
James Stith Hawkes, III 1978 92 p
Avail: Univ. Microfilms Order No. 7902053

Establishing a technique to estimate linear model parameters continues to be one of the most significant problems in statistical research. A class of biased estimators, variously known as ridge estimators, is given by B = 1/(X'X + K1) X'Y, where 1 denotes an identity matrix and K is a constant or a function Y. The ridge estimator was advocated as an alternative to the least squares estimator when the design matrix X'X is nearly singluar. A theoretical discussion of an expository nature is given and a number of results are presented which show certain properties of the ridge rule in relation to the least squares estimator. A linear model is considered which relates the average individual earnings in the U.S. to several variables such as age, schooling, etc. Using 1960 and 1970 census data, a number of estimators for the coefficients are considered, and the corresponding estimates are compared. Dissert. Abstr.

N79-19791 Missouri Univ. -Rolla.
SOME RESULTS ON INFERENCES FOR THE GAMMA AND DOUBLE EXPONENTIAL DISTRIBUTIONS Ph.D. Thesis
John Victor Grice 1978 49 p
Avail: Univ. Microfilms Order No. 7904334

Two articles are presented. The first article considers testing the mean of a gamma distribution. For the case that both parameters in the gamma distribution are unknown, approximate tests for the mean are derived and tables are provided for their

implementation. The power of the tests are compared to the power of the uniformly most powerful tests on the mean when the shape parameter is known. In addition, some limiting results are derived. The second article compares conditional and unconditional methods of constructing confidence intervals for the location parameter in the two-parameter double exponential distribution. Two modes of comparison are used and tables illustrating the comparisons are included. Dissert. Abstr.

N79-19792 Columbia Univ., New York.
MATHEMATICAL AND STATISTICAL ASPECTS OF THE EMBEDDING PROBLEM FOR MARKOV CHAINS Ph.D. Thesis
Halina Frydman 1978 125 p
Avail: Univ. Microfilms Order No. 7904078

The embedding problem for nonstationary continuous-time finite birth and death Markov chains is studied. A proof is given of the following general theorem: any nonsingular, totally positive stochastic matrix can be represented as a finite product of Jacobi Poisson matrices and hence is embeddable. This provides a full solution to the embedding problem for nonstationary continuous time birth and death Markov chain: a nonsingular stochastic matrix is embeddable in such a chain if and only if it is totally positive. For a given 3x3 stochastic matrix it is asked whether or not this matrix is embeddable. The following results are obtained: (1) necessary and sufficient conditions for embeddability of 3x3 stochastic matrix with at least one off-diagonal element equal to 0, (2) necessary and sufficient conditions for embeddability of a diagonally dominant 3x3 stochastic matrix, and (3) two sufficient conditions for embeddability of 3x3 stochastic matrix. Statistical aspects of the embedding problem are studied. Dissert. Abstr.

N79-19793# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A CHRONOLOGICAL ANNOTATED BIBLIOGRAPHY ON ORDER STATISTICS. VOLUME 1: PRE-1950 Technical Report, Feb. 1969 - Sep. 1977
H. Leon Harter Oct. 1978 516 p refs
(AD-A061768) Avail: NTIS HC A22/MF A01 CSCL 12/1

Let a sample of size n from a specified or unspecified population be arranged in nondecreasing order. Then the ordered sample values are collectively called the order statistics (plural) of the sample. In another sense of the expression, order statistics (singular) is that branch of the subject of statistics which deals with the mathematical properties of order statistics (plural) and with statistical methods based upon them. The majority of publications on order statistics deal with the order statistics of specific populations, and many of them involve the use of the sample order statistics to estimate one or more population parameters. The compiler of this bibliography makes a sharp distinction between order statistics and rank statistics, which is a branch of nonparametric statistics. Publications dealing with the ranks of the observations in the sample but not with the values (or expected values) of any of them will not in general be included in this bibliography; however, a few that are needed for comparison of methods based on ranks with alternatives based on order statistics will be included. Similarly, although the method of least squares is not based on order statistics, a substantial number of publications on least squares will be included because most alternative methods are based on order statistics and comparisons with the classical method of least squares are inevitable. GRA

N79-19794# SACLANT ASW Research Center, La Spezia (Italy).
A COMPARISON OF METHODS FOR OPTIMUM MATCHING OF THE MEAN VALUES OF TWO SAMPLES
Angela Mack and Maurice J. Daintith 15 Jun. 1978 40 p
(AD-A061838; SACLANTCEN-SM-109) Avail: NTIS HC A03/MF A01 CSCL 12/1

Two sample ranking methods are used to match the means of the two samples taken from a statistical population and results are compared with the random method. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N79-19795 Stanford Univ., Calif.
AGGREGATION OF POSITIVE LINEAR SYSTEMS Ph.D. Thesis
Ramine Rouhani 1978 176 p
Avail: Univ. Microfilms Order No. 7905920

The problem of aggregation, was, in general, looked at from the viewpoint of projection on eigenspaces. This requires the knowledge of nearly all eigenvalues and eigenspaces of the transition matrix. For positive systems, instead of looking for projection approximation of the output, the approach of the dissertation is to bound the output trajectory above and below for all time using an aggregate model. By fully exploiting the positiveness of the system, several methods of bounding the output are developed, where only partial information on the values of eigenvectors and eigenvalues are available. Dissert. Abstr.

N79-19796 Stanford Univ., Calif.
CONTRIBUTIONS TO COMPLEMENTARITY THEORY Ph.D. Thesis
Muhamed Aganagic 1978 129 p
Avail: Univ. Microfilms Order No. 7905809

A unified form of a number of different problems of mathematical programming is presented. The four independent parts discussed are: (1) iterative methods for linear complementarity problems; (2) variational inequalities and generalized complementarity problems; (3) on Q-matrices; are (4) on diagonal dominance in linear complementarity. Dissert. Abstr.

N79-19797 Northwestern Univ., Evanston, Ill.
IDENTIFICATION OF LINEAR DYNAMIC SYSTEMS Ph.D. Thesis
Yung-Chun Wu 1978 263 p
Avail: Univ. Microfilms Order No. 7903394

The problem of order determination and modeling of multi-input, multi-output, linear, time-invariant, discrete-time systems is considered from the input/output measurements for both the noise-free and noisy cases. The effect of an input sequence on identification is searched in detail. It is shown that the correctness of an order determined or a model identified is critically dependent on the input sequence used. There is always a possibility that the actual system is of higher order than the identified model(s) reveal. This uncertainty leads to the concept of tentative identification. The degree of the order determinability and the degree of the system identifiability are introduced. Sufficient conditions for correct order determination and system identification are also investigated. Procedures for order determination and modeling are developed. Dissert. Abstr.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-19798 Kent State Univ., Ohio.
GENERALIZED METRICS, QUASI-UNIFORMITIES, AND SEPARATION AXIOMS Ph.D. Thesis
Robert Dean Beggs 1978 59 p
Avail: Univ. Microfilms Order No. 7904793

A generalization of metric spaces is studied, and what types of topological spaces they generate are determined. In doing this quasi-uniformities are also studied. Dissert. Abstr.

N79-19799 Brown Univ., Providence, R. I.
ALPHA-CONDENSING MAPS AND DISSIPATIVE SYSTEMS Ph.D. Thesis
Gene David Cooperman 1978 96 p
Avail: Univ. Microfilms Order No. 7906531

Dissipative systems are a generalization of differential equations with Lyapunov functions. The main idea is that solutions should enter a given bounded set and stay there for all further time. Since the natural setting for delay differential equations is

in a Banach space, it is important to identify which definition of dissipative systems should be used in a particular application. Counterexamples are given to indicate where the best possible result was obtained. A theorem is proven which allowed extension of the results on alpha contractions to alpha condensing maps. Additional applications of the theorem include a generalization of a fixed point theorem, and of a continuous dependence theorem for fixed points, to the alpha condensing case. Dissert. Abstr.

N79-19800 Alabama Univ., University.
DIRECT PRODUCTS OF OPERATOR SEMIGROUPS WITH APPLICATIONS TO SEMIRINGS Ph.D. Thesis
Shirley Anne Murphy Edwards 1978 55 p
Avail: Univ. Microfilms Order No. 7905402

Necessary and sufficient conditions for an operator semigroup to be isomorphic to the direct product of operator semigroups are developed. Using this result together with Steinfeld's Theorem, it is proven that for semirings whose left ideals are both k and related, an analogue of the well-known six conditions equivalent to the Wedderburn-Artin Structure Theorem must hold. Applying the development of direct products of operator semigroups an analogue of the Krull-Schmidt Theorem is also proven.
Dissert. Abstr.

N79-19801 Brown Univ., Providence, R. I.
APPLICATIONS OF NONLINEAR APPROXIMATION THEORY TO THE MODEL REDUCTION PROBLEM Ph.D. Thesis
Leslie Voris Foster 1978 268 p
Avail: Univ. Microfilms Order No. 7906547

Cauchy approximation, a generalization of Pade approximation, is used to effect model reduction. As part of this development a new algorithm is introduced which supplies a solution to the uniqueness problem associated with Cauchy approximation and minimal partial realizations. A simple technique for forming a satisfactory stable model from an unstable simplified model of a given stable system is presented. Desirable properties are proven for procedures using Cauchy approximation and the stabilization scheme outlined and it is shown that several popular model reduction procedures have undersirable continuity properties. Quantitative estimates which locally compare a given model reduction procedure with a certain optimal model reduction procedure are introduced and are calculated for procedures which use Cauchy approximation. These analyses and the model reduction procedure developed are illustrated with a variety of scalar and multivariable examples. Dissert. Abstr.

N79-19802 Kent State Univ., Ohio.
COHERENCE AND TORSION THEORIES Ph.D. Thesis
Marsha Finkel Jones 1978 119 p
Avail: Univ. Microfilms Order No. 7904804

Coherence, and several generalizations of coherence are investigated relative to an hereditary torsion theory (T,F). The corresponding torsion radical is denoted by t and the localization of R with respect to T by Q. Finitely generated and finitely presented modules are investigated relative to (T,F), and it is shown that a finitely generated module M is t-finitely presented. A ring is right t-coherent if every finitely generated right ideal is t-finitely presented. The relationship between f-projectivity and flat epimorphisms of rings is shown. Rings for which every flat (right) module a directed union of finitely generated projective modules is investigated. It is shown that a ring R is right semihereditary and has this property precisely when every flat (right) R-module is f-projective and R has weak global dimension equal to or less than 1. Dissert. Abstr.

N79-19803 Alabama Univ., University.
CONNECTIVITY PROPERTIES OF PARTIALLY ORDERED SETS Ph.D. Thesis
Wallace Maryland, Jr. 1978 46 p
Avail: Univ. Microfilms Order No. 7905421

The notion of connected partially ordered sets (posets) is developed and some exponential properties as related to connected, extra-connected, and universally connected posets are presented. A problem was studied on direct product decompositions on finite connected posets. The unique factorization for connected graphs is proved, and these results are used to prove the direct product decomposition theorem for posets. The main application of the unique factorization theorem for posets is presented. A ring-theoretical concept called weak-inclusion is also developed and an application to the theory of posets is given which shows the power of this concept. Dissert. Abstr.

N79-19804 Cincinnati Univ., Ohio.
ARTINIAN SKEW GROUP RINGS AND SEMIPRIME TWISTED GROUP RINGS Ph.D. Thesis
Jae Keol Park 1978 57 p
Avail: Univ. Microfilms Order No. 7904759

An example of a skew group ring which is semiperfect but the group is infinite is discussed. Semilocal skew group rings over fields are characterized. Regular crossed products were studied. The negative answer to a question about the relation to the Krull dimension of a ring and that of the fixed ring under a finite group action is presented. Dissert. Abstr.

N79-19805 Iowa State Univ. of Science and Technology, Ames.
ASPECTS OF LINEAR REGRESSION ESTIMATION UNDER THE CRITERION OF MINIMIZING THE MAXIMUM ABSOLUTE RESIDUAL Ph.D. Thesis
Michael Lawrence Hand 1978 140 p
Avail: Univ. Microfilms Order No. 7903978

The study of the Chebyshev estimation is motivated by the discussion of its optimality properties when the error distribution is uniform. Some possible applications of the estimation procedure are discussed. It is shown that the Chebyshev estimator can be formulated and solved as a linear program and how this formulation relates to the classical exchange algorithms of approximation theory. Several properties of the Chebyshev solution are also given. Attention is devoted to the development of efficient algorithms for Chebyshev estimation. The problem of the distribution of an estimated parameter vector is examined. Applications of Chebyshev estimation are considered. Situations when Chebyshev estimation is likely to perform well are discussed. Also provided is a study of the efficiency of Chebyshev estimation relative to least square under a variety of distributional assumptions about the error vector. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N79-19806 State Univ. of New York at Stony Brook.
A STUDY OF MODELS IN KINETIC THEORY Ph.D. Thesis
John Peter Karkheck 1978 139 p
Avail: Univ. Microfilms Order No. 7905226

A survey of topics of current interest in the kinetic theory of fluids is given. Explicit models are studied to explore the predictive content, shortcomings, and possible pitfalls regarding the theory and application of kinetic equations. A technique is applied to the derivation of several kinetic equations from the Liouville equation of statistical mechanics. Nonanalytic temperature dependence of square-well fluid transport properties is established and the origin and nature of nonanalytic pieces is explored. The predictive content and general symmetry properties of various hard-sphere kinetic equations are examined. A study is made of the transport properties of the Widom-Rowlinson hard sphere model in the neighborhood of the critical point.
Dissert. Abstr.

N79-19807# New York Univ., N. Y. Magneto-fluid Dynamics Div.
RECONNECTION OF MAGNETIC LINES IN AN IDEAL FLUID Interim Report
Harold Grad Apr. 1978 48 p refs
(Contract EY-76-C-02-3077; Grant AF-AFOSR-2881-76)
(AD-A061973; MF-92; COO-3077-152; AFOSR-78-1498TR)
Avail: NTIS HC A03/MF A01 CSCL 20/3

The rate of reconnection of magnetic lines at an X-point, also growth of a tearing configuration have always been related to the presence of resistivity or other dissipative mechanisms. These phenomena, exhibiting nonconservation of magnetic line topology, are shown to occur in an ideal, nondissipative fluid, thereby violating beliefs, theorems, and calculations of over a

century (including the mathematically equivalent questions involving vortex lines in an ideal fluid). Author (GRA)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-19808 Maryland Univ., College Park.
MEASUREMENT OF MODAL DATA AND THE APPLICATION TO THE REDUCTION OF RADIATED NOISE Ph.D. Thesis
Robert Smith Reed, Jr. 1978 164 p
Avail: Univ. Microfilms Order No. 7905459

The noises radiating from a steel plate which was excited at a single point using various forcing functions were measured and analyzed as the noise problems. Noise, accelerometer, and force measurements were then made while the plate was being impacted at many locations. Modal data extracted from these measurements were used to generate the state variable model of the plate and the noise problems. The model was used to predict how the mode shapes could be modified, with the addition of masses, stiffeners, and dampers, in order to reduce the radiated noise. Several experiments were conducted which showed that the measured state variable model is very well suited to the problem of determining the effects of structural modification on the vibration and noise characteristics of a structure. Dissert. Abstr.

N79-19809 Cincinnati Univ., Ohio.
TRANSIENT SOLUTION OF ACOUSTIC PROBLEMS VIA THE FINITE ELEMENT METHOD Ph.D. Thesis
Richard Edward Hessel 1978 126 p
Avail: Univ. Microfilms Order No. 7904736

A method for solving transient acoustic problems using finite elements is developed. A new boundary condition for transient problems which is consistent with single frequency acoustic impedance conditions is proposed. Computer algorithms following finite element techniques were written to approximately solve these equations. Numerous examples indicate good agreement between analytical and numerical results. The method and formulation provide a means for obtaining solutions for previously intractable problems but is practical, in economic terms, only with an in-house computer. Dissert. Abstr.

N79-19810 Duke Univ., Durham, N. C.
A FINITE ELEMENT APPROACH TO DAMPED ACOUSTIC PROBLEMS Ph.D. Thesis
Bobby J. Stephens 1978 201 p
Avail: Univ. Microfilms Order No. 7905375

A method of analysis for the engineer who must deal with the acoustic response of complicated acoustic enclosures or other acoustic systems such as ducts, pipes, resonators, and mufflers. A pressure formulation of the nodal finite element method is used to obtain the discrete approximation of the sound field in such acoustic systems. Simple one, two, and three dimensional finite elements with a linear variation of the pressure between the nodes are used to construct the finite element models. Absorption of sound at the boundaries of the systems is accounted for by approximating the boundaries by a series of equivalent damping terms. With the boundary approximation incorporated in the discrete approximation, the resulting system of simultaneous equations is solved by a modification of Crout's method. A computer program named AFEP is included which generates and solves the system of simultaneous equations. Dissert. Abstr.

N79-19811 Northwestern Univ., Evanston, Ill.
ANISOTROPIC ULTRASOUND PROPAGATION IN LIQUID CRYSTALS Ph.D. Thesis
Sabyasachi Bhattacharya 1978 152 p
Avail: Univ. Microfilms Order No. 7903225

Propagation of longitudinal ultrasound in magnetically aligned liquid crystals was studied to determine the anisotropic hydrodynamic properties of various liquid crystalline symmetries and the dynamics of the phase transitions among them. All the better known symmetries, i.e., nematic, cholesteric, smectic-A, -B, and -C, were studied. Experiments were performed at various frequencies to separate the dispersive effects from the zero-frequency hydrodynamic behavior. The finite velocity anisotropy in the hydrodynamic regime in the smectic-A phase was confirmed. The velocity and attenuation anisotropy were measured in (1) a stable smectic-b phase; (2) a multidomain smectic-C liquid crystal; and (3) an aligned liquid cholesteric crystal. A strong anomaly in both the velocity and attenuation near a nematic-smectic-A phase transition was also studied. Dissert. Abstr.

N79-19812*# Lockheed-Georgia Co., Marietta.
THE NOISE AND FLOW CHARACTERISTICS OF INVERTED-PROFILE COANNULAR JETS
H. K. Tanna, B. J. Tester, and J. C. Lau Feb. 1979 382 p refs
(Contract NAS1-15018)
(NASA-CR-158995) Avail: NTIS HC A17/MF A01 CSCL 20A

A basic understanding of the noise reduction mechanisms in shock-free inverted-velocity-profile coannular jets was studied. Acoustic measurements are first conducted in an anechoic facility to isolate the effects of inverted velocity and inverted temperature for coannular jets having constant total thrust, mass flow rate and exit area. To obtain physical explanations of the measured noise changes, several types of experiments are conducted. These include (1) source location experiments using the polar correlation technique, (2) mean flow surveys using a combination pressure/temperature probe, and (3) detailed mean flow and turbulence measurements using a two-point four-channel laser velocimeter. The results from these experiments are presented and discussed in detail. Finally, the measured variations of coannular jet mixing noise with fan-to-primary velocity ratio and static temperature ratio are interpreted by utilizing the results from the various experimental phases in conjunction with the existing Lockheed single jet noise prediction model. Author

N79-19813*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLUCTUATING SURFACE PRESSURE AND ACOUSTIC RADIATION FOR SUBSONIC NORMAL JET IMPINGEMENT
John S. Preisser Mar. 1979 56 p refs
(NASA-TP-1361; L-12412) Avail: NTIS HC A04/MF A01 CSCL 20A

Results are presented from an experimental study of fluctuating surface pressures and far-field noise produced by a subsonic circular jet impinging normally to a large, rigid, flat surface. The tests were performed in an anechoic room for jet Mach numbers from 0.54 to 0.85 and for jet-to-surface heights from 5 to 10 jet diameters. Space and time correlations of surface pressure indicated a radially spreading, decaying pressure field having correlation lengths on the order of one-half the jet diameter with convection speeds between 0.5 and 0.6 of the peak wall-jet velocity. Overall sound pressure level varied as the eighth power of the jet velocity. Large-scale orderly structures in the flow were suggested by the noise spectra which peaked at a Strouhal number of about 0.3. In addition, an analytical formulation was given to approximate the apparent noise-producing regions of the flow in terms of cross-correlations and cross-spectra between the surface and far-field measurements. Results pointed to the impingement region of the flow field as the major contribution to the far-field impingement noise. L.S.

N79-19814*# MAN-Acoustics and Noise, Inc., Seattle, Wash.
A COMMERCIAL AIRPORT NOISE ENVIRONMENT: MEASUREMENT, PREDICTION AND CONTROL Final Report
J. E. Mabry and B. U. Sullivan Feb. 1979 72 p refs
(Contract NAS1-14404)
(NASA-CR-3107; MAN-1023-B) Avail: NTIS HC A04/MF A01 CSCL 20A

The data for a commercial airport noise measurement program included approximately 1,100 calibrated tape recordings at three observer positions and some 1500 supplementary peak level measurement at ten additional measurement points. For some individual airplane categories, there were substantial differences between results based on state-of-the-art noise prediction

technology and those based on actual measurements. Certain takeoff procedures resulted in significant noise reductions for particular airplane types. Also, there was some evidence that specific categories of airplanes can be flown with reduced ranges of peak noise levels. Author

N79-19815*# United Technologies Research Center, East Hartford, Conn.
AIRFRAME NOISE COMPONENT INTERACTION STUDIES Final Report
Martin R. Fink and Robert H. Schlinker Mar. 1979 138 p refs
(Contract NAS1-15083)
(NASA-CR-3110; R78-912996-12) Avail: NTIS HC A07/MF A01 CSCL 20A

Acoustic wind tunnel tests were conducted of a two-dimensional wing section with removable high-lift leading and trailing edge devices and a removeable two-wheel landing gear with open cavity. An array of far field conventional microphones and an acoustic mirror directional microphone were utilized to determine far field spectrum levels and noise source distribution. Data were obtained for the wing with components deployed separately and in various combinations. The basic wing model had 0.305 m (1.00 ft) chord, which is roughly 1/10 scale for a one-hundred passenger transport airplane. Most of the data were obtained at 70.7 and 100 m/sec (232 and 328 ft/sec) airspeeds, which bracket the range of practical approach speeds for such aircraft. Data were obtained at frequence to 40 kHz so that, when scaled to s typical full-airframe, the frequency region which strongly influences preceived noise level woud be included.
Author

N79-19816# Naval Air Development Center, Warminster, Pa.
PLRAY - A RAY PROPAGATION LOSS PROGRAM
Charles L. Bartberger 26 Oct. 1978 248 p refs
(AD-A062019; NADC-77296-30) Avail: NTIS HC A11/MF A01 CSCL 20/1

PLRAY is a ray propagation loss program similar in many respects to FACT. It computes propagation loss as a function of range at constant depth in a horizontally stratified ocean with a flat bottom. It does this by computing a family of rays and interpolating between them to obtain the intensities of the various multipath arrivals at the specified receiver locations. Like FACT, PLRAY provides the option of incoherent or semicoherent ray addition. It contains wave corrections for smooth caustics but not for cusped caustics. The cusped caustic errors are minimized by separating the source and receiver slightly in depth. It also contains a surface duct model which replaces ray computations for propagation in a surface duct. PLRAY incorporates two features not included in FACT; it permits the user to insert his own bottom loss curves in place of the internally contained curves and it makes provision for insertion of a beam pattern. Although occasionally significant differences in output are observed, PLRAY and FACT generally yield comparable resutls. Author (GRA)

N79-19817# Naval Ocean Systems Center, San Diego, Calif.
GREY-SCALE VERSUS COLOR CODING OF ACOUSTIC DATA IMAGES Final Report, Oct. 1976 - Sep. 1977
Robert S. French Mar. 1978 64 p
(AD-A061646; NOSC/TR-207) Avail: NTIS HC A04/MF A01 CSCL 20/6

Acoustic data images were studied using both grey-scale and color coding for 8 to 64 discriminable levels of information. Display image encoding using 8 discriminable levels of grey-scale or color was shown to provide good perception of pattern features. Beyond 8 levels, it was increasingly more difficult to distinguish individual levels and pattern perception was degraded. With 32 to 64 levels of quantization available, excellent pattern perception was achieved using a color 'band-step' coding scheme. The color bands code the major levels of amplitude, while the intensity gradient within each band highlights contouring and provides for finer amplitude discrimination. The use of six color bands of 5 to 10 intensity steps within each band was particularly effective. Color displays were shown to be superior for the perception of patterning, contouring, and equivalent amplitudes and also to be equivalent to grey-scale displays for discriminating patterns of very weak signals in noise. Author (GRA)

N79-19818# Army Engineer Topographic Labs., Fort Belvoir, Va.
INVESTIGATION OF ELECTRO-ACOUSTIC TECHNOLOGY FOR TOPOGRAPHIC APPLICATIONS
Frederick W. Rohde Sep. 1978 12 p
(AD-A061820; ETL-0160) Avail: NTIS HC A02/MF A01 CSCL 20/1

Studies were made of surface acoustic wave (SAW) and acousto-optical (A/O) devices for image processing and feature extraction from images. In the report, each device is defined, signal processing with the devices is discussed, and topographic applications for the devices are reviewed. The report concludes that the devices may be used in signal processing and decision circuitry for topographic systems, for example, distance measurement equipment (DME), radar return receivers, and image analyzers. Author (GRA)

N79-19819# Virginia Highway and Transportation Research Council, Charlottesville.
EFFECTIVENESS OF PREDICTIVE COMPUTER PROGRAMS IN THE DESIGN OF NOISE BARRIES, A BEFORE AND AFTER APPROACH. PART 1: THE DATA ACQUISITION SYSTEM Interim Report, Jun. 1975 - Feb. 1978
J. K. Haviland and D. F. Noble Feb. 1978 99 p refs
(PB-288896/4; VHTRC-78-R32-Pt-1; FHWA/VA-78-R32) Avail: NTIS HC A05/MF A01 CSCL 13B

A digital data acquisition system was designed to meet the need for a long duration noise analysis capability. By sampling the DC outputs from sound level meters, it has been possible to make twenty-four hour or longer recordings, in contrast to the one-hour recordings on seven-inch analog tape reels. The system is made up of a digital tape recorder, an analog-to-digital converter, an outdoor microphone unit, a weatherproofed microphone, two B & K sound level meters, and other miscellaneous equipment. It has the capability of recording and analyzing data from up to eight channels in linear or decibel format. The operation of the system in terms of its setup, calibration, and the recording of digitized signals, as well as the computer programs used to analyze the signals, are described in this report. Listings of computer programs and of a sample problem are supplied in the appendixes. GRA

N79-19024*# Florida Univ., Gainesville.
A METHODOLOGY FOR ESTIMATING DOG NOISE IN AN ANIMAL HOUSING FACILITY
S. E. Sierens, H. A. Ingley, and E. L. Besch *In* NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 167-177 refs (For primary document see N79-19013 10-12)
(Grant RR00942)
Avail: NTIS HC A20/MF A01 CSCL 20A

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-19820 California Univ., Berkeley.
EXCITED STATE ELECTRON SPIN COHERENCE (ESESC) STUDIES OF TRIPLET STATES IN MOLECULAR SOLIDS Ph.D. Thesis
Marc Edward Tarrasch 1978 110 p
Avail: Univ. Microfilms Order No. 7904622

The field of coherent spectroscopy of two-level systems is applied to the lowest triplet state of organic molecules. By neglecting the triplet sublevel not coupled by the field, the remaining two levels with Feynman-Vernon-Hellwarth geometrical representation of a general two-level system are described. The equations of motion of the pseudomagnetization are derived after transformation to the rotating frame, as are Bloch-type equations which include phenomenological relaxation times. The loss of coherence due to exchange between triplet states with different Larmor frequencies but identical zero-field dipolar tensor axes is then discussed. By writing two sets of coupled Bloch equations, expressions for the effective decay rate and frequency shift of the experimentally monitored triplet system are derived and

discussed in the limits of slow and rapid exchange. Calculations for off-resonance rotary echo intensities are presented and extended to include triplet sublevel population kinetics and inhomogeneous broadening. Dissert. Abstr.

N79-19821 Maine Univ., Orono.
STUDIES OF THE APPLICATION OF PSEUDOPOTENTIALS TO MOLECULAR CALCULATIONS Ph.D. Thesis
Peter George Whitkop 1978 236 p
Avail: Univ. Microfilms Order No. 7906040

Molecular calculations involving two types of pseudopotential methods were carried out with the alkali metal diatomic molecule ions Li(+)2, Na(+)2, K(+)2 and the alkaline earth diatomic molecule Mg2. The calculations of the ground state and first excited state potential curves for the alkali metal diatomic molecule ions were carried out within the Simons type model potential formalism, while the calculation of the ground state and excited state potential curves of Mg2 involved an ab-initio pseudopotential approach. The alkali metal diatomic molecule ions were chosen as a test of the validity of the Simons type model potential in extensive molecular calculations because the absence of electron correlation allows easy interpretation of the results. Magnesium 2 was studied in an effort to gain insight into other pseudopotential methods and because it represents a good theoretical model of the group IIB eximers, which are possible laser candidates. Dissert. Abstr.

N79-19822 Wisconsin Univ. - Madison.
PHOTOELECTRON SPECTROSCOPY USING A VARIABLE WAVELENGTH RADIATION SOURCE AND A FIRST ORDER FOCUSING CYLINDRICAL MIRROR ELECTRON ENERGY ANALYZER Ph.D. Thesis
Frederick Leon Baudais 1978 263 p
Avail: Univ. Microfilms Order No. 7822238

A cylindrical mirror molecular photoelectron analyzer was designed, constructed, and evaluated with windowed rare gas resonance lamps and with wavelength dispersed synchrotron radiation from an electron storage ring. For this instrument employing 1.0 mm slits and using wavelength dispersed synchrotron radiation, an effective resolution of 0.0086 was obtained, without source electron acceleration, discriminated against electron energies below 2.0 eV. The effects of autoionization on the lowest ionic band of ethylene were examined with excitation energies between 14.20 eV and 16.35 eV. The energies of the Rydberg states agreed with recent photoionization mass spectral studies from these laboratories. Dissert. Abstr.

N79-19823 Wisconsin Univ. - Madison.
A PHOTOIONIZATION STUDY OF HYDROGEN BOUND CLUSTERS IN A SUPERSONIC MOLECULAR BEAM Ph.D. Thesis
Kelsey Donald Cook 1978 190 p
Avail: Univ. Microfilms Order No. 7822246

A supersonic molecular beam used to prove autoassociation of hydrogen bonding systems was sampled by a quadrupole mass spectrometer whose sampling axis was perpendicular to the beam. Ionization was accomplished using either wavelength-dispersed vacuum ultraviolet radiation from an electron storage ring or by electron impact. In experiments with methanol, CH3OD, ethanol, and trifluoroethanol, ions were detected corresponding to the series (ROH) sub n H(+). Dependence of relative ion intensities on beam source temperature indicated that cluster ions derived from unique cluster parents, rather than multiple fragmentation of a single large cluster. To test further whether the beam expansion affected the sampled equilibria, several experiments were performed with acetic acid. Finally, the beam was used to study the important ammonia system.
Dissert. Abstr.

N79-19824 Stanford Univ., Calif.
HIGH RESOLUTION SPECTROSCOPY USING MULTIPLE COHERENT INTERACTIONS Ph.D. Thesis
James Neil Eckstein 1978 129 p
Avail: Univ. Microfilms Order No. 7905850

A technique of Doppler-free high resolution spectroscopy that makes use of the coherent excitation of atoms in a gas by a train of pulses was developed. The frequency resolution is much greater than that obtained with a single pulse. The pulse train is tuned to be resonant with an atomic two photon transition, and by an appropriate mirror configuration the atoms see a periodic sequence of standing waves, causing the excitation to be Doppler-free. The frequency spectrum of such a train of pulses consists of a set of discrete modes, separated exactly by the inverse of the period of the pulse train, namely 1 tau. Resonant multiple pulse two photon excitation occurs, as the mode spectrum is scanned, when the mode pattern is symmetrically placed around one half the transition frequency. Since the modes are precisely a space apart in frequency, many pairs of modes can then simultaneously satisfy the condition that their sum frequency equals the two photon transition frequency. Dissert. Abstr.

N79-19825 Indiana Univ., Bloomington.
A STUDY OF RELATIVISTIC EFFECTS IN THE INNER SHELL IONIZATION OF ATOMS BY ELECTRONS Ph.D. Thesis
John Tsekrisme Ndefru 1978 109 p
Avail: Univ. Microfilms Order No. 7906738

Total cross sections for the ionization of the inner atomic shells by electrons were calculated in the relativistic plane wave born approximation (RM-PWBA) using the Moller interaction between the incident and ejected electrons. Dirac plane and hydrogenic wave functions are used to describe the projectile and atomic electrons, respectively. The importance of using the Moller interaction which incorporates the retardation effect is investigated by comparing the results of the RM-PWBA with those obtained from the use of the Coulomb interaction between two electrons. For incident energies of a few times the ionization energy, these two results differ almost by a factor two. The use of the Coulomb interaction alone fails to provide reasonable agreements between the calculations and the observations at these energies in the plane wave born approximation.
Dissert. Abstr.

N79-19826 State Univ. of New York at Buffalo.
DETERMINATION OF A GROUND STATE WAVEFUNCTION FOR HELIUM IN MOMENTUM SPACE Ph.D. Thesis
Paul John Schreiber 1978 127 p
Avail: Univ. Microfilms Order No. 7905318

The helium atom nonrelativistic Hamiltonian is considered in coordinate space. Terms representing the electrostatic interaction energy of each helium atomic electron with the nuclear electric charge are retained in the Hamiltonian. The atomic electron-electron electrostatic interaction energy is replaced with Fontana's one-center expansion of the energy. This helium Hamiltonian with Fontana's expansion is used to express the corresponding helium Schrodinger equation in coordinate space. Application of the Fourier transformation to the helium coordinate space Schrodinger equation gives three integral terms called the kinetic energy, nuclear-electron, and electron-electron integrals. The Dirac transformation defines the coordinate space wavefunction in terms of the momentum space wavefunction and is used to evaluate the kinetic energy integral. The result is the momentum and energy operators acting on the momentum space wavefunction. Dissert. Abstr.

N79-19827 Ohio State Univ., Columbus.
ANISOTROPIC INTERACTIONS IN DILUTE ORTHOHYDROGEN ALLOYS Ph.D. Thesis
William Thomas Cochran 1978 106 p
Avail: Univ. Microfilms Order No. 7902098

Pulsed nuclear magnetic resonance studies were performed on dilute orthohydrogen in a parahydrogen lattice. These measurements were made at a frequency of 30 MHz on orthohydrogen concentration between .1 and 1 percent and at temperatures between 4K and .02K. It was found that the resonance spectrum could be deconvoluted into six distinct components of which three were identified as singles with different order parameters. Any phase transition in the concentration range was neither complete nor co-operative. The phase transition in the concentration range cannot be identified with that at higher concentrations. If forced to give a transition temperature, it decreases with increasing concentration. Quantum diffusion rates were found to be extremely slow in the concentration range. No increase in the signal identified as that due to nearest-neighbor pairs was seen with time at a temperature of .04K. Dissert. Abstr.

N79-19828*# Colorado State Univ., Fort Collins. Dept. of Physics.
INDUSTRIAL ION SOURCE TECHNOLOGY Annual Report
Harold R. Kaufman and Raymond S. Robinson Dec. 1978 73 p refs
(Grant NsG-3088)
(NASA-CR-159534) Avail: NTIS HC A04/MF A01 CSCL 20H

An analytical model was developed to describe the development of a coned surface texture with ion bombardment and simultaneous deposition of an impurity. A mathematical model of sputter deposition rate from a beveled target was developed in conjuction with the texturing models to provide an important input to that model. The establishment of a general procedure that will allow the treatment of manay different sputtering configurations is outlined. Calculation of cross sections for energetic binary collisions was extened to Ar, Kr.. and Xe with total cross sections for viscosity and diffusion calculated for the interaction energy range from leV to 1000eV. Physical sputtering and reactive ion etching experiments provided experimental data on the operating limits of a broad beam ion source using CF4 as a working gas to produce reactive species in a sputtering beam. Magnetic clustering effects are observed when Al is seeded with Fe and sputtered with Ar(±) ions. Silicon was textured at a micron scale by using a substrate temperature of 600 C. L.S.

N79-19829# Kansas State Univ., Manhattan. Dept. of Chemistry.
CHEMISTRY OF ELECTRONICALLY EXCITED STATES OF ATOMS. DIATOMIC MOLECULES AND DIATOMIC IONS Final Report
D. W. Seiser 1 Oct. 1978 14 p refs
(Grant DAAG29-75-G-0018)
(AD-A062023; ARO-12197.10-C) Avail: NTIS HC A02/MF 01 CSCL 20/5

The chemistry of the metastable states of the rare gases was studied using the flowing afterglow technique. Quantitative measurements were made for the total quenching rate constants and rate constants for product formation. This work led to the discovery of the reactive quenching processes between the metastable atoms and halogen molecules; the products are the rare gas halide excimers in high yield. These systems subsequently have been developed into useful lasers in the ultraviolet region of the spectrum. Collisions of the excited states of the rare gas atoms with other atoms also have been characterized. Rate constants are large and exit channels may be far below the energy of the entrance channel. Author (GRA)

N79-19830# JAYCOR, Del Mar, Calif.
DEVELOP AND PERFORM EXPERIMENTS FOR HIGH INTENSITY CHARGED PARTICLE BEAMS Final Report
Rodney L. Burton 30 Jun. 1978 19 p refs
(Contract N00014-77-C-0667)
(AD-A061816; J78-6056-FR) Avail: NTIS HC A02/MF A01 CSCL 20/7

The work performed and completed under this contract comprised an evaluation of ion transport methods and a preliminary ion transport experiment, including: Operation of NRL GAMBLE I facility in positive polarity for ion beam generation; Design and development of ion diodes appropriate to the GAMBLE I accelerator; Application of appropriate diagnostics for determining ion yield of diodes and realization of a ballistic ion focus at the target plane; Design and development of an ion transport feasibility experiment for GAMBLE I; and Perform preliminary evaluation of ion transport mechanisms and efficiency. GRA

N79-19831# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
MOLECULAR BEAM STUDIES OF SULFUR HEXAFLUORIDE CLUSTERING IN AN ARGON CARRIER GAS FROM BOTH FREE JET AND LAVAL NOZZLE SOURCES
Barry G. Deboer, Sang Soo Kim, and Gilbert D. Stein Nov. 1978 13 p refs Presented at the 11th Intern. Symp. on Rarefied Gas Dyn., Cannes, France, 3-8 Jul. 1978
(Contract N00014-76-C-0378)
(AD-A061810; TR-5) Avail: NTIS HC A02/MF A01 CSCL 18/2

Experiments on adiabatic expansions of SF6 in an argon carrier gas reveal that it readily nucleates and grows in the small free jets and Laval nozzles used as molecular beam sources. One free jet orifice and one nozzle of approximately the same throat size were used in this work. Limits for the onset of clustering leading to intense 'molecular' beams have been determined by varying the intial pressure, initial temperature, SF6 mole fraction and gas expansion (and cooling) rate. As anticipated, the Laval nozzle is a much more efficient cluster generator than the free jet. High energy electron diffraction has been employed to ascertain the cluster size, crystalline structure (body centered cubic), and unit cell dimensions as functions of the initial conditions. Estimates of the cluster temperatures have been made from their cell dimensions. Author (GRA)

N79-19832# Illinois Univ. at Urbana-Champaign. Dept. of Chemistry.
A NEW METHOD FOR SOLVING THE COUPLED EQUATIONS IN THE ADIABATIC REPRESENTATION
Vasil K. Babamov Aug. 1978 35 p refs Submitted for publication
(Contract N00014-75-C-0942)
(AD-A061988; TR-8) Avail: NTIS HC A03/MF A01 CSCL 20/10

A new method for solving the coupled equations in the adiabatic representation which arise in quantum mechanical treatment of atomic and molecular collisions is developed. The solutions of the uncoupled adiabatic equations, obtained from the coupled equations in the adiabatic representation by neglecting the coupling terms, are used to derive a set of new exact equations for the purely inelastic effects of the collision. The solutions of the new equations are practically nonoscillatory and can be solved numerically with little computational effort.
Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N79-19833 Oregon State Univ., Corvallis.
AVERAGE BETA AND GAMMA DECAY ENERGIES OF THE FISSION PRODUCTS Ph.D. Thesis
Chi Hung Wu 1978 122 p
Avail: Univ. Microfilms Order No. 7903614

One method of predicting the decay-heat is the 'Summation Method' in which the power produced by decay of each fission product at time t after shut-down is calculated. The reactor shut-down power produced at time t is then obtained by summing over all of the fission products. An accurate determination of the average beta and gamma decay energies is essential for the success of this method. Two summation method calculations were performed using ROPEY, a summation method code. Treating other input parameters, namely, half-lives, branching ratios, and independent nuclear fission product yields as fixed, decay-heat calculated compared better than a calculation using the existing Evaluated Nuclear Data File B-IV did with the American Nuclear Society Decay-Heat Standard for the decay time between 1 and 60 seconds. Between 60 and 10,000 seconds of decay time experimental data dominate the results, which are virtually identical. Dissert. Abstr.

N79-19834 Stanford Univ., Calif.
RELATIVISTIC MANY-BODY STUDIES OF NUCLEAR MATTER AT FINITE TEMPERATURE Ph.D. Thesis
Roger Arthur Freedman 1978 237 p
Avail: Univ. Microfilms Order No. 7905863

The properties of nuclear matter are studied as a function of temperature and density. The model employed for nuclear matter is a relativistic quantum field theory in which nucleons interact with massive scalar mesons and massive vector mesons. The techniques of quantum statistical mechanics, particularly those based on the use of Green's functions, are used to extract physical information from this field theory. The thermal conductivity of

nuclear matter was also studied. A fully relativistic expression is found in linear response theory for the low temperature thermal conductivity based on one-pion exchange. This expression is inversely proportional to the temperature and approximately proportional to the number density of nucleons at high density.
Dissert. Abstr.

N79-19835 Wisconsin Univ. - Madison.
THE OPTICAL MODEL FOR ELASTIC SCATTERING OF POLARIZED DEUTERONS FROM MEDIUM-WEIGHT NUCLEI Ph.D. Thesis
Robert Paul Goddard 1978 235 p
Avail: Univ. Microfilms Order No. 7823064

Measurements of differential cross sections and vector and tensor analyzing powers for elastic scattering of 10 to 15 MeV deuterons from a variety of medium-weight nuclei were analyzed in terms of the optical model. Potentials were found which reproduce nearly all of the measurements. These are the first successful optical model fits to all four analyzing powers for deuteron scattering from nuclei with A greater than 40 for energies above the Coulomb barrier. The properties of the tensor potential were also investigated. The optical model program used for these calculations utilizes a more accurate method of computing derivatives of the calculated observables with respect to the analyzing powers. Uncertainties and correlations claculated by the program are used to estimate uncertainities in the best-fit potentials. Dissert. Abstr.

N79-19836 California Univ., Los Angeles.
APPLICATION OF A VARIATIONAL PRINCIPLE TO THE SOLUTION OF A SYSTEM OF THREE QUARKS Ph.D. Thesis
Joseph Francis Rondinone 1978 146 p
Avail: Univ. Microfilms Order No. 7906195

A rapidly convergent variational method was developed for the solution of the nonrelativistic quantum mechanical three body problem. This solution consists of a series developed by systematic optimization of each term by a nonlinear variational technique. The method is suitable for three body systems whose constituents interact via arbitrary central or noncentral potentials. The solutions compare favorably with more complicated linear variational solutions for harmonic oscillator, and exponential with hard core potentials. The method is applied to three quark systems containing u and d quarks in order to construct a simple unified potential model for baryons and mesons. Dissert. Abstr.

N79-19837 Wisconsin Univ. - Madison.
INVESTIGATION OF DEUTERON HALF SPIN FLIP IN Ni-60 (D,D' GAMMA) Ni-60 WITH A POLARIZED BEAM Ph.D. Thesis
Randall Keith Tenhaken 1978 239 p
Avail: Univ. Microfilms Order No. 7822274

The angular correlation between deuterons inelastically scattered from the first excited state of Ni60 and 1.33 MeV gamma-rays subsequently emitted perpendicular to the reaction plane was measured with a vector polarized deuteron beam at an incident energy of 12 MeV. This correlation uniquely chooses scattered deuterons that have undergone a change in magnetic quantum number of one unit along the perpendicular to the scattering plane. Those deuterons are defined as having undergone half spin flip. Angular distributions of differential cross section and analyzing power were also measured. Angular distributions of the unpolarized beam half spin slip probability, and that portion of the vector analyzing power associated with deuteron half spin flip, were directly determined from the angular correlation and inelastic scattering date. Dissert. Abstr.

N79-19838 Stanford Univ., Calif.
DEEP-INELASTIC ELECTRON SCATTERING FROM NUCLEI Ph.D. Thesis
Jay Wallace VanOrden 1978 120 p
Avail: Univ. Microfilms Order No. 7905945

Inelastic electron scattering is considered in the region of energy and momentum transfer associated with the quasielastic and 3-3 resonance peaks. Particular emphasis is placed on the role of mesonic processes in the dip between the quasielastic and 3-3 resonance peaks. Calculations of quasielastic scattering, two-nucleon ejection via the two-body meson-exchange current, and pion electroproduction from threshold through the 3-3 resonance peak are presented. The meson-exchange contribution is found to be significant in this region, and tends to partially account for the descrepancy between theory and experiment in the dip region. Both meson-exchange and pion production contributions are found to be essentially transverse while the quasielastic contribution is almost equally divided between longitudinal and transverse components. The angular dependence and scaling of each contribution are discussed.
Dissert. Abstr.

N79-19839 Iowa State Univ. of Science and Technology, Ames.
PARTON-PICTURE UNITARY IMPACT-PARAMETER MODEL FOR MULTICLUSTER PRODUCTION Ph.D. Thesis
Van Chang 1978 70 p
Avail: Univ. Microfilms Order No. 7903961

The parton picture is used to study multiparticle production in high energy hadronic interactions in the framework of the unitary impact parameter parton model and the quark recombination model. In the unitary impact parameter parton model, an inelastic structure function is deduced from the multiperipheral parton model. This inelastic structure function as a function of impact parameter is found to be constant for small impact parameter collisions, with a rapidly falling tail in the region peripheral interactions near the nucleon radius. It is also shown that the constant part of this inelastic structure function is responsible for the central pionization products and that the falling tail part is responsible for the fragmentation products. In the quark recombination model, an appropriate form for the qq bar and qqq joint momentum distribution function is deduced in which phase space restrictions can be consistently included.
Dissert. Abstr.

N79-19840 California Univ., Los Angeles.
ELEMENTARY PARTICLES IN A CURVED SPACE Ph.D. Thesis
John Fang 1978 102 p
Avail: Univ. Microfilms Order No. 7906167

Four related subjects are reported which represent a series of investigations on the theory of elementary particles in a curved space. This includes more than the title can comprise; also included are related subjects in flat space and the nonlinear theory of gravitation. Part 1 is devoted to massive and massless spin-2 fields in de Sitter space. Linearized Einstein field equations with cosmological terms are reconstructed from the particle physicist's point of view based on the de Sitter space-time background. In Part 2 the nonlinear theory of the massless spin-2 field are constructed, and this question from the point of view of a deformation of the gauge group is discussed. In Part 3 the wave equations for massless fields with any spin in flat space are presented. In Part 4 these wave equations are generalized for spin to de Sitter space. Dissert. Abstr.

N79-19841 Purdue Univ., Lafayette, Ind.
MEASUREMENTS OF TWO PARTICLE PRODUCTION IN 400 GeV/c PROTON-NUCLEUS COLLISIONS Ph.D. Thesis
David Anthony Finley 1978 247 p
Avail: Univ. Microfilms Order No. 7905718

Results are presented for an experiment which used a double-arm magnetic spectrometer to perform inclusive measurements of two particle production in 400 GeV/c proton-nucleus collisions. The apparatus detected two particles with an azimuthal separation of approximately 180 deg which were produced near a rapidity of -0.4 in the proton-nucleon center-of-mass system. Charged hadrons which were produced in polyethylene, beryllium and lead targets, were identified over the transverse momentum range from 1 to 1.8 GeV/c. The dependence of the production on the number of nucleons (A) in the target nucleus is parameterized. Both the transverse momentum and quantum number correlations are very much reduced by using a lead target. Dissert. Abstr.

N79-19842 Wisconsin Univ. - Madison.
MULTILEPTON PRODUCTION BY NEUTRINOS Ph.D. Thesis
Thomas Donn Gottschalk 1978 223 p
Avail: Univ. Microfilms Order No. 7822254

Mechanisms for multielepton production in deep inelastic

neutrino scattering are investigated; predicted distributions are compared with recent multimuon data. A three component model is proposed for trimuon production based on conventional single muon production accompanied by an additional-dimuon pair. Predictions of the two-component model for antineutrino induced trimuons and same-sign dimuons are presented. Multilepton mechanisms based on production of new heavy particles are also considered. Detailed calculations are presented for two models. Maximum multimuon rates for quark cascade multileptons in the SU(2) sub L x U(1) sub R gauge theory are examined. Present data provide no evidence for the existence of these new physics mechanisms. Dissert. Abstr.

N79-19843 Ohio Univ., Athens.
A N/D METHOD FOR THE CALCULATION OF INELASTIC SCATTERING AMPLITUDES Ph.D. Thesis
Philip Scott Honsinger 1978 89 p
Avail Univ. Microfilms Order No. 7904833

The N/D formalism is used to develop a method for calculating partial wave scattering amplitudes using the R function to express the inelasticity. Besides the inelasticity, the discontinuity of a near portion of the left branch cut of the amplitude and the amplitude in the gap between the left and right branch cuts are used as input to the method. The discontinuity across a far part of the left branch cut is parameterized and the parameters are fixed by requiring the N/D amplitude to closely agree with the given gap amplitude. The method is tested with several models and under various conditions and found to work very well. Excellent physical region solutions can result from left cuts which can vary considerably in detail with the model and among each other. It is proposed that the method actually gives an approximate analytic continuation of the gap into the physical region and that there is a family of left cuts found through this continuation which is consistent with the approximate gap amplitude. Dissert. Abstr.

N79-19844 California Univ., Davis.
CHARGED AND NEUTRAL PARTICLE PRODUCTION FROM 400 GeV/c PROTON-PROTON COLLISIONS Ph.D. Thesis
Richard David Kass 1978 137 p
Avail: Univ. Microfilms Order No. 7905198

Charged and neutral particle production from 400 GeV/c pp collisions is studied using Fermilab's fifteen foot bubble chamber. The experiment is described in detail. The data is analyzed in the language of Inclusive Reactions. Values for the charged multiplicity distribution at 400 GeV/c are presented. Moments of the distribution are calculated and studied as a function of laboratory momentum. Dissert. Abstr.

N79-19845 California Univ., Berkeley.
PION PION SCATTERING BY POLE EXTRAPOLATION METHODS Ph.D. Thesis
Fredrick Wilbur Lott, III 1978 69 p
Avail: Univ. Microfilms Order No. 7904528

A 25-inch hydrogen bubble chamber was used to produce 300,0000 pictures of pion (+) P interactions at an incident momentum of the pion (+) of 2.67 GeV/c. The 2-prong events were processed using the FSD and the FOG-CLOUDY-FAIR data reduction system. These events were used to extrapolate to the pion pole in order to investigate the interaction with isospins of both T=1 and T=2. Two methods were used to do the extrapolation: the original Chew-Low method and the Durr-Pilkuhn method which takes into account centrifugal barrier penetration factors. At first it seemed that, while the Durr-Pilkuhn method gave better values for the total pion pion cross section, the Chew-Low method gave better values for the angular distribution. Further analysis, however, showed that if the requirement of total OPE were dropped, the Durr-Pilkuhn method gave more reasonable values of the angular distribution as well as for the total pion pion cross section. Dissert. Abstr.

N79-19846 Stanford Univ., Calif.
A MEASUREMENT OF THE PROTON STRUCTURE FUNCTIONS USING INELASTIC ELECTRON SCATTERING Ph.D. Thesis
Mac Donald Mestayer 1978 174 p
Avail: Univ. Microfilms Order No. 7905905

Measurements of inclusive electron scattering cross sections from hydrogen are reported for beam energies between 6.5 GeV and 19.5 GeV and for electron scattering of 6, 19, 15, 18, and 20.6 degrees. These measurements were taken using an accelerator and a 20 GeV spectrometer. Details of the experiment and the analysis are presented along with an estimate of the systematic errors on the cross section. Dissert. Abstr.

N79-19847 California Univ., Berkeley.
WEAK INTERACTION EFFECTS IN POSITRON ELECTRON ANNIHILATION WITH POLARISED BEAMS Ph.D. Thesis
Richard Simard 1978 70 p
Avail: Univ. Microfilms Order No. 7904607

Heavy lepton production in e(+)e(-) annihilation when one of the incident beams is longitudinally polarized and the purely leptonic decay of this heavy lepton is examined. An asymmetry in the inclusive angular distribution of one charged lepton (electron or muon) will be important in determining the structure of weak interactions of the heavy lepton. In fact, this angular asymmetry will easily distinguish between the cases V - A and V + A for the heavy lepton current. Then, the decay channel L yields Na sub L + one hadron (L = heavy lepton) is considered under the same experimental set-up, and the inclusive one-hadron angular distribution is examined. Finally a test is proposed which will provide unambiguous and clear evidence for parity violation in E(+)e(-) annihilation. Dissert. Abstr.

N79-19848 California Univ., Berkeley.
PARTICLE ORDER: A NEW FUNDAMENTAL CONCEPT IN HADRON PHYSICS Ph.D. Thesis
George Weissmann 1978 290 p
Avail: Univ. Microfilms Order No. 7904647

The concept of particle order is introduced in its simplest form, sequential order. It is shown how sequential order, together with the general principles of the S-matrix theory provide a description for a broad range of mesonic regularities. The scheme is extended to all hadrons by a generalization of the concepts of order. Stringent self-consistency requirements are shown to determine the specific form of the theory, including such features as topological color, baryon number conservation and a set of generalized OZ1 rules. The spectrum is shown to consist of nonexotic mesons and baryons, and well-defined classes of exotic particles, all obeying the zero-triality rule. An attempt is made to understand the physical interpretation of order, which may well turn out to be a most fundamental concept in hadron physics. Dissert. Abstr.

N79-19849 Brown Univ., Providence, R. I.
A STUDY OF N-15(n,d) C-14 AND N-15(n, t) C-13 GROUND STATE REACTIONS AS FUNCTIONS OF ENERGY AND ANGLE IN THE NEUTRON ENERGY RANGE 13.6 TO 14.8 MeV Ph.D. Thesis
James Richard Bading 1978 261 p
Avail: Univ. Microfilms Order No. 7906516

Techniques were developed for producing neutron spectra having the characteristics needed for excitation function measurements. A method was also developed for measuring the neutron spectrum incident on a reaction target. The N-15 reaction data were taken with a counter telescope which consisted of two gas differential energy detectors plus a scintillator. Excitation functions were measured at counter angle settings of 0 deg and 45 deg over the neutron energy range 13.6 through 14.8 MeV. Cross section angular distributions were taken at En = 14.1 and 14.6 MeV. At forward angles the 14.1 MeV sigma(theta) for N-15(n, d)C-14 g.s., disagrees with a previously reported measurement. The direct mechanism was found to be completely dominant for the (n,d)reaction. A DWBA analysis gives a fairly good fit to the shape of the observed angular distribution for N-15(n,d)C-14 g.s., but predicts an energy dependence different from that observed. Dissert. Abstr.

N79-19850 Ohio Univ., Athens.
PENETRATION OF A TWO DIMENSIONAL FISSION BARRIER Ph.D. Thesis
Shivnath Dutta 1978 79 p
Avail: Univ. Microfilms Order No. 7904830

A collective desciption is presented of fission dynamics by attempting a numerical solution of Schrodinger equation in two dimensions. The two collective variables in which the formalism

is based are: r, the fission degree of freedom and theta the mass asymmetry degree of freedom. The two dimensional model was used to calculate the fission fragment mass distribution of U-238. Dissert. Abstr.

N79-19851 Duke Univ., Durham, N. C.
A HIGH RESOLUTION STUDY OF THE LOWEST 1/2+ ANALOGUE STATE IN Nb-91 Ph.D. Thesis
Mark Eric Bleck 1978 193 p
Avail: Univ. Microfilms Order No. 7905343

Excitation functions for the reaction Zr(p,p)-90 were measured from 5.684 to 5.992 MeV at laboratory angles of 90, 107, 135 and 160 degrees. Proton energy resolution varied between 425 and 450 eV. The data were fit to an R-matrix cross section containing 302 s-wave resonances. These levels comprise the fine structure of the lowest 1/2(+) analogue state in Nb-91/ Dissert. Abstr.

N79-19852 British Library Lending Div., Boston Spa (England).
FAST REACTOR FUELS REPROCESSING TECHNOLOGY
J. Sauteron, J. Couture, P. Roblin, and M. Bourgeois 1978 10 p Transl. into ENGLISH from Bull. Inform. Sci. Tech. (Paris), no. 223, May-Jun. 1977 p 71-77 Presented at Intern. Conf. on Nucl. Power and Its Fuel Cycle, Salzburg, Austria, 2-13 May 1977
(BLL-Risley-TR-3392-(9091.9F); IAEA-CN-36/567) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Several problems still have to be solved before proceeding from the experimental stage to the industrial phase: significant calorific release, treatment of high specific activity solids and solutions, insoluble residues, manipulation of large quantities of plutonium, and waste treatment. A large-scale R & D program is underway, aiming to deal with the above problems within a given time scale (laboratory, chemical engineering, AT1 workshop, Marcoule pilot plant, scale one prototype tests, design studies). The program concerns the head-end section of the process (handling, chopping, dissolving and clarification of solutions), solvent extractions, and PuO2 elaboration. At each stage, the program examines problems concerning liquid, gaseous and solid waste, inspection methods and remote handling technology. In addition to the work on the aqueous reprocessing technique, a dry process was developed under laboratory conditions which utilises uranium and plutonium hexafluorides to separate them from fission products. Results obtained with plutonium fuels emphasise the importance of this technique which presents potential advantages for both economy and safety. A.R.H.

74 OPTICS

Includes light phenomena.

N79-19853 Arizona Univ., Tucson.
THE PRACTICAL APPLICATION OF MODULAR METHODS TO OPTICAL SYSTEM DESIGN Ph.D. Thesis
Douglas Warren Anderson 1978 178 p
Avail: Univ. Microfilms Order No. 7906410

Modular optical design, the process of selecting and combining modules to form an optical system with assigned first-order properties, provides an alternative to the usual methods of initiating an optical design, the steps prior to use of an optimizing computer program. Existing equations for the third-order aberrations, in terms of the modular parameters which could be solved to identify values of the power parameters for which the various aberrations were zero for the system, are expanded to include the fifth-order aberrations. Techniques are presented, primarily restrictions in the range of variation of the shape parameters which help to control this problem of unreasonable thicknesses and curvatures. Conditions under which a real stop exists are derived and conditions which should assure convergence of the design in an optimizing program are presented. Factors which assist in the selection of indices of refraction are also discussed. Dissert. Abstr.

N79-19854# Royal Aircraft Establishment, Farnborough (England).
LIGHTING THEORY IN PRACTICAL SITUATIONS
H. J. Leebeek Oct. 1978 23 p refs Transl. into ENGLISH of "Verlichtingstheorie in de Praktijk", Rept. 1978-17 Inst. voor Zintuigfysiologie, Netherlands, 1978
(RAE-LIB-Trans-1989; BR66837) Avail: NTIS HC A02/MF A01

The main terms and definitions of luminance, luminous intensity, illuminance, luminous flux, and reflection are presented in relation to the source-human eye combination. The subjective appraisal of the visual environmental by means of luminance ratio is described. Daylight and sunshade data with recomended illuminances, and color spects or lighting are presented. M.M.M.

N79-19855*# California Univ., San Diego, La Jolla. Dept. of Applied Physics and Information Science.
STUDIES IN OPTICAL PARALLEL PROCESSING Final Report
Sing H. Lee 31 Oct. 1978 41 p refs
(Grant NGR-05-009-264)
(NASA-CR-158237) Avail: NTIS HC A03/MF A01 CSCL 20F

Threshold and A/D devices for converting a gray scale image into a binary one were investigated for all-optical and opto-electronic approaches to parallel processing. Integrated optical logic circuits (IOC) and optical parallel logic devices (OPA) were studied as an approach to processing optical binary signals. In the IOC logic scheme, a single row of an optical image is coupled into the IOC substrate at a time through an array of optical fibers. Parallel processing is carried out out, on each image element of these rows, in the IOC substrate and the resulting output exits via a second array of optical fibers. The OPAL system for parallel processing which uses a Fabry-Perot interferometer for image thresholding and analog-to-digital conversion, achieves a higher degree of parallel processing than is possible with IOC. A.R.H.

N79-19856# Cornell Univ., Ithaca, N. Y.
IMPURITY INDUCED ABSORPTION IN POTASSIUM BROMIDE CRYSTALS FOR INFRARED OPTICAL APPLICATIONS Final Technical Report, 1 Apr. 1975 - 31 Mar. 1977
A. J. Sievers, R. O. Pohl, R. Alexander, Y. Chabal, and A. Chraplyvy Jul. 1978 149 p refs
(Contract F19628-75-C-0177)
(AD-A061794; RADC-TR-78-164) Avail: NTIS HC A07/MF A01 CSCL 20/5

Investigations of the optical properties of (pure) and doped alkali halide crystals between 9 micrometers and 11 micrometers were carried out using CO2 lasers and Michelson interferometers. The extrinsic absorption due to residual impurities in purified alkali halides was used to categorize the optical quality of the crystals. The absorption in doped crystals was studied both interferometrically from which the internal vibrational modes of the molecular impurities were identified, and by means of saturation spectroscopy from which excited-state lifetimes of molecular vibrations were determined. GRA

N79-19857# California Inst. of Tech., Pasadena.
OPTICAL DATA PROCESSING AND STATISTICAL OPTICS Final Report, 1 Jul. 1976 - 30 Jun. 1978
George Nicholas Oct. 1978 41 p refs
(Contract F49620-76-C-0021; Grant AF-AFOSR-2234-72; AF Proj. 2305)
(AD-A061959; AFOSR-78-1506TR) Avail: NTIS HC A03/MF A01 CSCL 20/6

This final scientific report contains a summary of research at Caltech on the wavelength sensitivity of speckle. Included in this bibliography are research publications by N. George, A. Jain, A. Livanos, R.D.S. Melville, C.H. Papas, and J. Roth. Topics in speckle supported under the subject contract are described: (1) diffraction by a serrated aperture, and (2) propagation in an experimental test chamber containing a turbulent gaseous mixture. Research on the fabrication of grating structures for use in integrated optics is also described. Chirped or variable period gratings have been successfully made by a holographic process. Briefly, a waveguiding layer of Corning 7059 glass is sputtered onto a substrate glass using the Technics MIM Model 5.5 ion-beam etching machine. Photoresist is coated onto the waveguiding layer, exposed holographically in an argon or helium-cadmium

laser beam, developed and then ion-milled. Extensive theory and technique are reported in the bibliography of publications listed in this report. Author (GRA)

N79-19858# Pennsylvania Dept. of Transportation, Harrisburg. Bureau of Materials, Testing and Research.
FIELD EVALUATION OF THE GAMMA SCIENTIFIC MODEL 910B RETROREFLECTOMETER Final Report
Gerald J. Malasheskie and Frank W. Block Jul. 1978 43 p (PB-289209/9; PDT-77-16) Avail: NTIS HC A03/MF A01 CSCL 14B

The field testing of the Gamma Scientific Model 910B Retroreflectometer is described. It is an evaluation of the accuracy, reliability, and over-all performance of the instrument under varying environmental conditions. The study concludes that the Model 910B Retroreflectometer is a suitable measurement device for determining the specific luminance ('brightness') of Class 1 reflective sheeting material, in the field. It is recommended that this field test device be used to enforce manufacturers' warranties for reflective sign sheeting, test regulatory signs for required replacement, inspect sign materials used on construction and maintenance projects, and provide a quality control tool for PennDOT Sign Shop personnel. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-19859 Columbia Univ., New York.
APPLICATION OF DISCRETE-ORDINATES TRANSPORT METHODS TO ANALYSIS OF FUSION/FISSION HYBRID BLANKETS Ph.D. Thesis
Stephen L. Ostrow 1978 217 p
Avail: Univ. Microfilms Order No. 7904110

In order to realize the potential benefits resulting from the combination of fusion and fission technologies into an integrated fusion/fission hybrid reactor system, it is essential to develop sound calculational techniques of neutronics analysis. The design details of proposed hybrid reactors vary greatly from study to study, and the first actual such system will probably be still different from any of the present designs. Therefore, this thesis concentrates on simple, idealized models, allowing for relatively unambiguous interpretation of results. Dissert. Abstr.

N79-19860 Purdue Univ., Lafayette, Ind.
NUMERICAL SIMULATION OF MAGNETICALLY CONFINED PLASMAS UNDERGOING CYCLOTRON RESONANCE HEATING Ph.D. Thesis
Jeffrey Wayne Daugherty 1978 240 p
Avail: Univ. Microfilms Order No. 7905712

A set of mathematical and computational tools were developed which can be used to study the behavior of magnetically confined plasmas heated by a process known as Electron Cyclotron Resonance Heating (ECRH). The hot, tenuous plasmas, consisting of electrons and protons, are confined by strong mirror-like magnetic fields. The heating is accomplished by irradiating the plasma with a microwave source whose frequency is adjusted to match the natural cyclotron gyrofrequency of the electrons. A plasma model, the Kinetic Macroscopic Hybrid (KMH) model is formulated. A computer code, the KMH code, is developed with the KMH model. With the KMH code the plasma increase in its concentration in regions of weak magnetic field during ECRH were made observable. Dissert. Abstr.

N79-19861 Maryland Univ., College Park.
HIGH-ENERGY ION EXPANSION IN LASER-PLASMA INTERACTIONS Ph.D. Thesis
Real Decoste 1978 153 p
Avail: Univ. Microfilms Order No. 7905464

The high-energy ions produced from the intense laser irradiation of solid targets are studied both experimentally and theoretically. The ion diagnostics include both charge collectors and an ion analyzer especially designed for energetic ion studies. Analyzer design considerations are presented together with a calibration technique of the ion detection system involving the measurement of secondary electron emission. A technique using charge exchange to differentiate ion species with the same A/Z but using different Z is also described. A 1-D fluid model described the ambipolar expansion of hot electrons and either one or two relatively cold ion species from an electron pressure gradient. Dissert. Abstr.

N79-19862 Maryland Univ., College Park.
LASER SCATTERING MEASUREMENTS OF PLASMA TURBULENCE IN A FAST THETA PINCH Ph.D. Thesis
Steven Harvey Gold 1978 129 p
Avail: Univ. Microfilms Order No. 7906640

The Maryland High Voltage Theta Pinch is used to study the turbulent heating of a low density cylindrical deuterium plasma by the sudden application of a large axial magnetic field. This results in a collisionless imploding shock wave that heats and compresses the plasma. Small angle CO2 laser scattering can directly sense density fluctuations produced by microinstabilities driven by this magnetic implosion. These microinstabilities are responsible for electron and ion heating and are used to determine gross properties of the theta pinch implosion dynamics. Turbulent density fluctuations were measured at a wavelength near the Debye length at several points within and behind the current sheet of the imploding shock that is driven by the magnetic implosion. Two main scattering features were found that have different width, amplitude, direction, and timing, as well as a different parametric dependence on the initial plasma density. Dissert. Abstr.

N79-19863 Princeton Univ., N. J.
CHARACTERISTICS AND LIFETIME OF CONVECTIVE PLASMA MOTIONS IN TOKAMAKS Ph.D. Thesis
Adilnawaz Badrudin Satchu Hassam 1978 122 p
Avail: Univ. Microfilms Order No. 7905626

The time evolution, due to dissipative processes, of an initial pattern of poloidal and toroidal flows in a tokamak is considered. The calculation is applicable to collisional, low beta, axisymmetric tokamaks of arbitrary minor cross section. Time rates of change of poloidal flows which are subsonic but larger than the diamagnetic speed are given according to the magnitude of the flow and the collisionality of the plasma. The effects of a magnetic field inhomogeneity on convective cells and their collective transport are examined. A slab calculation shows, firstly, that the convective cell, which is a zero-frequency mode of the homogeneous plasma, is transformed into the interchange mode in a system with an inhomogeneous magnetic field. Secondly, in the inhomogeneous field, the convective cell damps by magnetic pumping at a rate much faster than perpendicular viscous damping (for tokamak-like parameters). Dissert. Abstr.

N79-19864 Johns Hopkins Univ., Baltimore, Md.
RENORMALIZED PLASMA KINETIC THEORY-GENERAL STRUCTURE AND RELAXATION PROPERTIES Ph.D. Thesis
Robert Eli Terry 1979 264 p
Avail: Univ. Microfilms Order No. 7906500

A plasma kinetic theory is developed which provides a statistical description of plasma turbulence by rigorously incorporating the initial distribution functions into an extended statistical mechanics. With the hypothesis that strong particle interaction is a necessary condition for turbulent plasma evolution and upon specializing the subdynamics to select phase space domains implying either strong interaction or its absence, the extended statistical mechanics becomes a statistics of the detailed space-time structure of a turbulent plasma. Hastened thermalization was observed in theta-pinch plasma, and its characteristics support, qualitatively, the hypothesis of strong interaction as a necessary condition for turbulent evolution. Observed dispersion curves for electrostatic waves in a turbulent magnetoplasma support this new ensemble averaging concept more than the conventional notion of stochastic fields. Dissert. Abstr.

N79-19865 Johns Hopkins Univ., Baltimore, Md.
EUV EMISSIONS AND GRAD B-DRIFT TRANSPORT IN TOKAMAK DISCHARGES Ph.D. Thesis
James Layton Terry, II 1979 191 p
Avail: Univ. Microfilms Order No. 7906490

Impurity emissions from the high density-high temperature discharges of the Alcator Tokamak were found to be poloidally asymmetric. The physical phenomenon responsible for the unexpected asymmetries was investigated, and the experimental evidence strongly supports the conculsion that they are caused by compensated impurity ion drifts, which result from the gradient and curvature inherent in the confining magnetic field. The total amount of power lost from Alcator discharges through line radiation was determined. Impurity ions were primarily responsible for the loss. The radiated-power-loss estimate was based upon the measurement of the central chord emissions from a number of impurity ions and the measurement of the spatially resolved emissions from selected impurity ions. The temporal and spatial evolution of oxygen ions during a disruptive instability was measured by spatially resolving the ion emissions. Dissert. Abstr.

N79-19866*# State Univ. of New York at Buffalo, Amherst.
EXPERIMENTAL AND THEORETICAL INVESTIGATION FOR THE SUPPRESSION OF THE PLASMA ARC DROP IN THE THERMIONIC CONVERTER
D. T. Shaw, C. N. Manikopoulos, T. Chang, C. H. Lee, and N. Chiu 31 Dec. 1977 98 p refs Sponsored in part by NSF and ERDA
(Grant NsG-7071)
(NASA-CR-158248; LAPES-77-003) Avail: NTIS HC A05/MF A01 CSCL 20I

Ion generation and recombination mechanisms in the cesium plasma as they pertain to the advanced mode thermionic energy converter were studied. The decay of highly ionized cesium plasma was studied in the near afterglow to examine the recombination processes. Very low recombination in such a plasma may prove to be of considerable importance in practical converters. The approaches of external cesium generation were vibrationally excited nitrogen as an energy source of ionization of cesium ion, and microwave power as a means of resonant sustenance of the cesium plasma. Experimental data obtained so far show that all three techniques - i.e., the non-LTE high-voltage pulsing, the energy transfer from vibrationally excited diatomic gases, and the external pumping with a microwave resonant cavity - can produce plasmas with their densities significantly higher than the Richardson density. The implication of these findings as related to Lam's theory is discussed. M.M.M.

N79-19867*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION CONFINEMENT AND TRANSPORT IN A TOROIDAL PLASMA WITH EXTERNALLY IMPOSED RADIAL ELECTRIC FIELDS
J. Reece Roth, Walter M. Krawczonek, Edward J. Powers (Texas Univ. Austin), Young C. Kim (Texas Univ., Austin), and Hae Y. Hong (Texas Univ., Austin) Mar. 1979 86 p refs
(NASA-TP-1411; E-9754) Avail: NTIS HC A05/MF A01 CSCL 20I

Strong electric fields were imposed along the minor radius of the toroidal plasma by biasing it with electrodes maintained at kilovolt potentials. Coherent, low-frequency disturbances characteristic of various magnetohydrodynamic instabilities were absent in the high-density, well-confined regime. High, direct-current radial electric fields with magnitudes up to 135 volts per centimeter penetrated inward to at least one-half the plasma radius. When the electric field pointed radially toward, the ion transport was inward against a strong local density gradient; and the plasma density and confinement time were significantly enhanced. The radial transport along the electric field appeared to be consistent with fluctuation-induced transport. With negative electrode polarity the particle confinement was consistent with a balance of two processes: a radial infusion of ions, in those sectors of the plasma not containing electrodes, that resulted from the radially inward fields; and ion losses to the electrodes, each of the which acted as a sink and drew ions out of the plasma. A simple model of particle confinement was proposed in which the particle confinement time is proportional to the plasma volume. The scaling predicted by this model was consistent with experimental measurements. L.S.

N79-19868# Missouri Univ. -Rolla.
PART 1: COHERENCE EFFECTS IN PENNING IONIZATION. PART 2: VOLUME RECOMBINATION PROCESSES AT HIGH PRESSURES Technical Report, Dec. 1977 - Dec. 1978
Laird D. Schearer and W. E. Parks 1 Dec. 1978 12 p
(Contract N00014-75-C-0477)
(AD-A061704; TR-12) Avail: NTIS HC A02/MF A01 CSCL 20/9

A thermal energy beam source of rare gas metastable atoms (He,Ne,Ar) has been designed and constructed. These low energy high flux beams have been used to excite ions of the Group II metal atoms in Penning ionizing collisions. We find that optical emission from the excited ions is linearly polarized along the beam axis. This non-statistical population of the ml states of the excited ion is a sensitive measure of the interaction between the reactants of the Penning collision process. We have also examined kinetic processes related to volume recombination of electrons and ions in the afterglow of a laser initiated discharge in a mixture of potassium atoms in a high pressure buffer of Krypton. Time dependent optical emission from excited states populated in the afterglow of an ionizing laser pulse is utilized to determine electron temperatures and densities. The electron energy loss rate can then be determined. Author (GRA)

N79-19869# Naval Research Lab., Washington, D. C.
A PERSPECTIVE ON SELF-GENERATED MAGNETIC FIELDS Interim Report
J. A. Stamper 27 Oct. 1978 42 p refs
(AD-A061944; NRL-MR-3872) Avail: NTIS HC A03/MF A01 CSCL 20/9

Self-generated magnetic fields in the megagauss range have recently been re-confirmed by Faraday rotation diagnostics of laser-plasma coupling. These fields, through their inhibition on thermal transport, could have an important effect in pellet design. There has been impressive progress over the last decade, both experimentally and theoretically, toward understanding the physics of the magnetic fields. The newer results can be seen in the historical perspective of the many past contributions described in the published literature. Direct experimental studies have utilized both physical probes (coils) and Faraday rotation of a polarized, probing laser beam. (Experimental x-ray studies have also provided indirect evidence for the fields by requiring thermal transport inhibition in a self-consistent 2-D numerical modelling of the laser-plasma interactions). The rich variety of theoretical studies includes magnetic field effects in ordinary and magnetic resonant absorption. A 3-channel diagnostic system, utilizing Faraday rotation of a Raman-shifted beam, has allowed a study of the magnetic field dependence on several experimental conditions-particularly timing and the presence of a pre-formed plasma. Future work includes determining the importance of the fields at the lower irradiances now under consideration for pellets, and measuring the fields in the critical region where resonant absorption and radiative forces are important. Author (GRA)

N79-19870# Air Force Weapons Lab., Kirtland AFB, N. Mex.
SHIVA ELECTROMAGNETIC IMPLOSION X-RAY SOURCE Final Report
J. H. Degnan, M. C. Clark, J. F. Kiuttu, C. R. McClenahan, and William L. Baker May 1978 53 p refs
(AD-A061884; AD-E200170) Avail: NTIS HC A04/MF A01 CSCL 20/9

The generation of pulsed high-energy density plasmas by electromagnetic implosion of cylindrical foils (i.e., imploding liners or hollow Z-pinches) has been investigated experimentally and theoretically at the Air Force Weapons Laboratory. The experimental studies involve discharging a 1.3 microsecond, 1.1 megajoule capacitor bank through 7 cm radius, 2 cm tall, 3 to 30 mg cylindrical foil liners. Typical discharge parameters are 7 to 12 MA peak current and 1-1.5 microsecond current rise time. Current and voltage waveforms indicate strong coupling of the load to the capacitor bank, and analysis of the waveforms indicates good implosion of the current sheath. Optical and magnetic probe measurements are consistent with 1 to 2 cm thickness of the imploding plasma shell and with final implosion velocities. Comparison of electrical, magnetic, and radiation data with one dimensional magnetohydrodynamic and two dimensional magneto-hydrodynamic calculations is presented. The prospects for improving the performance with the present energy source and scaling to larger energy sources are briefly discussed. GRA

N79-19871# Georgia Inst. of Tech., Atlanta. School of Physics.
SUMMARY QUESTIONNAIRE Summary Report, 1 Nov. 1977 - 31 Oct. 1978
E. W. McDaniel and I. R. Gatland 1 Nov. 1978 5 p refs
(Contract N00014-76-C-0015)
(AD-A061886) Avail: NTIS HC A02/MF A01 CSCL 07/4

The Ga Tech program of research on ionic transport in gases is described. Experimental measurements of ionic mobilities and diffusion coefficients are discussed. The use of the mobility data to obtain ion-neutral interaction potentials is described. References to recent publications are given, and the program for the next year is outlined. Author (GRA)

N79-19872# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
THE INFLUENCE OF DIFFUSION AND REABSORPTION OF RADIATION ON THE PARTICLE AND ENERGY BALANCE OF AN INFINITELY LONG QUASI-CYLINDRICAL DISCHARGE IN HYDROGEN GAS
W. J. Geodheer Sep. 1978 54 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-78-111) Avail: NTIS HC A04/MF A01

A model, which accounts for the diffusion of electrons, ions and neutral atoms in the ground state and for the reabsorption of Lyman-alpha and Lyman-beta radiation in an infinitely long quasi-cylindrical discharge in hydrogen gas was constructed. The transport theory for a toroidal plasma of high collisionality was used. The assumptions that form the basis are discussed. J.M.S.

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N79-19873 Washington State Univ., Pullman.
THE ELECTRON WORK FUNCTION OF RHENIUM WITH DISSOLVED CARBON AND GRAPHITIC SURFACE LAYERS Ph.D. Thesis
Paul George Pallmer, Jr. 1978 128 p
Avail: Univ. Microfilms Order No. 7903589

The solubility of carbon in rhenium was measured by combustion and its change with carburizing temperature was determined by lattice expansion as measured by X-ray diffraction. The atomic ratio of carbon to rhenium was 21 times the increase of the a-axis lattice parameter in nanometers. The increase of solubility with temperature corresponded to a heat of solution of carbon in rhenium of 19 plus or minus 2.5 kJ/mol. The emissivity of rhenium, measured as 0.42 plus or minus .02, was not changed by carbon in solution. Carbon on the surface increased the emissivity to 0.70 plus or minus 0.10. The electron work function of 5.0 at. percent carbon-rhenium was measured by a retarding potential method, with the carburized rhenium ribbon as anode. Carbon accumulation on the surface produced a lower work function, reaching a value of 0.9 plus or minus 0.1 eV less than that of rhenium for a 150 K lowering of the temperature. Dissert. Abstr.

N79-19874 Minnesota Univ., Minneapolis.
THEORY AND EXPERIMENTS OF LOW-FREQUENCY I/f NOISE IN MOSFET'S Ph.D. Thesis
Sheng-Yueh Pai 1978 57 p
Avail: Univ. Microfilms Order No. 7906364

The frequency, gate voltage, drain voltage and processing dependences of low frequency noise were measured and the surface state density determined by charge-pumping and capacitance-versus-gate voltage measurements. It found, both experimentally and theoretically, that the noise voltage spectrum (referred to the gate) measured at low drain voltage is directly proportional to the surface state density. The drain voltage dependence of noise voltage spectrum can be deduced from the gate voltage dependence of noise voltage spectrum, by an integration procedure. Therefore, the gate voltage dependence of noise voltage spectrum, is sufficient to characterize the whole bias dependence. For ion-implanted devices, the enhancement-mode devices behave like conventional devices, but the depletion-mode devices show G-R type of noise at low gate bias caused by damage around the buried channel. Dissert. Abstr.

N79-19875 Oregon State Univ., Corvallis.
INJECTION OF ELECTRONS INTO SILICON DIOXIDE FROM PLANAR SILICON SUBSTRATES Ph.D. Thesis
Ajit Govind Rode 1979 138 p
Avail: Univ. Microfilms Order No. 7905615

An effort was made to characterize the electron emission process from silicon into silicon dioxide. Three types of devices were fabricated, duffused injection structure (DIS), partially ion implanted shallow n(+)-p junction (D229) and inverted bipolar injection device (IBID) that was also partially ion implanted. Injection of electrons into silicon dioxide could be detected as oxide current in DIS structures. Current densities, as high as 6 micron A/sq cm were detected, before the oxide breakdown occurred. There was no electron injection observed in the ion implanted D229 and IBID devices. The charge trapped in the oxide can be detected by a shift in the C.V plot. No such shift was observed for any of the three devices. Dissert. Abstr.

N79-19876 State Univ. of New York at Buffalo.
COMPUTATION OF CHARGE DISTRIBUTIONS AND COMPARISON WITH EXPERIMENT Ph.D. Thesis
John Anthony Rys 1978 132 p
Avail: Univ. Microfilms Order No. 7905313

HONDO is a program which utilizes an efficient algorithm for the evaluation of two-electron integrals. The method is based on properties of a set of a set of orthogonal polynomials, the zeros and weight factors of which yield Gaussian quadrature formulae exact for a wide class of integrals involving Gaussian-type basis functions. The algorithm is particularly suited to the computation of integrals involving high angular momentum basis functions. Extended basis set SCF wavefunctions obtained from HONDO were used primarily in a comparative study of theoretical and experimental charge densities. Methods were developed for calculating dynamic molecular densities from static wavefunctions. Experimentally determined rigid-body translational and librational thermal parameters are applied to the Fourier transformed density. The treatment applied to formamide and the azide ion. Dissert. Abstr.

N79-19877 Wisconsin Univ. - Madison.
EFFECTS OF ROTATIONALLY INELASTIC COLLISIONS ON THE TRANSPORT PROPERTIES OF ATOM/DIATOMIC GAS MIXTURES: THE GENERALIZED PHASE SHIFT (GPS) APPROACH Ph.D. Thesis
Robert Reynolds Wood 1978 353 p
Avail: Univ. Microfilms Order No. 7822278

Two aspects of the kinetic theory of gases are considered: (1) the evaluation of statistical averages of rotationally inelastic cross sections; and (2) the calculation of the transport coefficients of a dilute mixture of diatomic molecules in an atomic species. The method referred to as the Generalized Phase Shift (GPS) approach is applied to the inelastic scattering of an atom and a homonuclear diatomic molecule. A four-parameter model of a nonspherical interaction potential is introduced, and the rotational energy moments of the degeneracy averaged cross sections are numerically evaluated. Calculations are carried out for five sets of molecular parameters, one of which represents the Ar/N2 system. Dissert. Abstr.

N79-19878 Stanford Univ., Calif.
MATRIX PRODUCTS WITH APPLICATIONS TO CLASSICAL STATISTICAL MECHANICS, 1. REFLECTIVITY OF ONE-DIMENSIONAL SOLIDS, 2 Ph.D. Thesis
Mark Alan Novotny 1978 148 p
Avail: Univ. Microfilms Order No. 7905907

A matrix product that generalizes the Kronecker product (the direct product of matrices) is introduced. Numerous theorems concerning the properties of this matrix product and its relationships with Kronecker, Hamard, and regular matrix multiplication are stated and proved. Its application to the study of models in classical statistical mechanics that have one- and two-body interactions is demonstrated in the mapping from a specialized Blume-Emery-Griffiths-Rys spin one model to a spin 1/2 Ising model with a temperature dependent magnetic field.

Also a model that is a combination of a one-dimensional and mean field model is introduced and discussed. An apparatus and technique developed to obtain the visible and near infrared polarized reflectivity spectra of small (tenths of a millimeter) single crystals is described. The polarized room temperature single crystal reflectivity of three classes of quasi-one-dimensional compounds is analyzed. Dissert. Abstr.

N79-19879 Nebraska Univ. - Lincoln.
MAGNETIC PROPERTIES OF THE RARE-EARTH INTERMETALLICS RGa2 Ph.D. Thesis
Ter-Hsin Tsai 1978 106 p
Avail: Univ. Microfilms Order No. 7906233

Magnetic ordering and indirect exchange interactions were studied in the series of hexagonal rare-earth intermetallic compounds RGa2, where R denotes Ce, Pr, Nd, Gd, Tb, Dy, Ho, and Er. The magnetic susceptibility (X) of polycrystalline samples was measured at low fields, from 1.5 K to about 300 K; the magnetization (M) versus applied magnetic field (H) of these polycrystalline samples and a HoGa2 single crystal was measured up to 80 kOe at low temperatures; the resistivities of CeGa2, GdGa2, DyCa2, and HoGa2 were measured from about 1.5 to about 300 K, at zero field. The X(T) and M(H) results indicate that the samples order antiferromagnetically. The antiferromagnetic ordering temperatures T sub N were estimated; they ranged from 6.4 K for DyGa2 to 14.8 K for TbGa2. High temperature X(T) results were fitted to the Curie-Weiss formula and the resulting effective moments are in good agreement with those expected for trivalent rare-earth ions. Dissert. Abstr.

N79-19880 Johns Hopkins Univ., Baltimore, Md.
THE EFFECTS OF CARBON AND HYDROGEN ON THE ELECTRONIC AND OPTICAL PROPERTIES OF AMORPHOUS BORON THIN FILMS Ph.D. Thesis
George Wishard Turner 1979 124 p
Avail: Univ. Microfilms Order No. 7906492

The effects of carbon and hydrogen introduced into vacuum deposited amorphous boron thin films was investigated. Changes in the electronic and optical properties of the films as functions of impurity content were determined. Impurity analysis was performed by Secondary Ion Mass Spectrometry (SIMS) and infrared absorption measurement. Electronic measurements that were performed included ac. and dc. conductivity as a function of temperature, thermopower, mobility, conductivity modulation by applied electric field (field effect), photoconductivity, and magnetoresistance. Optical measurements included infrared absorption, reflectivity in the .63 to .86 micron range, and interferrometric thickness determination. Dissert. Abstr.

N79-19881 State Univ. of New York at Buffalo.
STABILITY OF THIN SOLID FILMS Ph.D. Thesis
Charles S. Dunn 1978 156 p
Avail: Univ. Microfilms Order No. 7905336

A small amplitude perturbation analysis is used to determine the conditions under which a solid film, several hundred Angstroms thick, on a substrate will rupture. If the perturbation grows with time, the film is unstable and rupture may occur; whereas if the perturbation decays, the film is stable. The thin film is assumed to behave like an elastic body. The difference in forces which act on a volume element in a film thinner than the range of interaction forces between the atoms of the film and substrate, and in a bulk solid is accounted for by introducing a body force into the equations of displacement of an elastic solid. Because of the difficulties in writing boundary conditions at the film-substrate interface, two limiting situations are considered: a thin film on a rigid substrate, and a thin free film. A critical internal stress necessary for rupture is identified. Dissert. Abstr.

N79-19882 Texas Technological Univ., Lubbock.
ULTRASONIC SURFACE WAVES ON BULK SUPERCONDUCTING ZINC Ph.D. Thesis
Eddie Hearl Breashears 1978 130 p
Avail: Univ. Microfilms Order No. 7904958

Ultrasonic surface wave attenuation measurements were conducted on the surface of a high purity zinc single crystal in the normal and superconducting states for specific orientations with propagation parallel to the <0001>, <1010>, and <1120> directions. Surface acoustic wave (SAW) interdigital transducers were designed and fabricated to generate and detect these surface waves on Y cut, Z propagation direction (YZ) lithium niobate (LiNbO3), ST-X quartz, and XY quartz piezoelectric substrates at a fundamental frequency near 10 MHz. The zinc sample surface was studied in both the free state and also while completely bound to the surface of the interdigital transducer. The ultrasonic surface wave attenuation was continuously recorded as a function of temperature. The various electronic attenuations and the anisotropic BCS superconducting energy gaps were determined at 10 MHz for these orientations. Dissert. Abstr.

N79-19883 Indiana Univ., Bloomington.
EFFECTS OF THE CORE HOLE PERTURBATION OF THE X-RAY SPECTRA OF METALS AND IMPURITY SYSTEMS Ph.D. Thesis
Garnett Woodruff Bryant 1978 188 p
Avail: Univ. Microfilms Order No. 7906726

Calculations were done for the outer shell absorption and emission spectra of Li, Na, Mg, Al, K, Rb and Cs. In addition, calculations were done for the impurity systems F(-) in Na, F(-) in K and Ne in K. The effects of the core hole perturbation on X-ray spectra were studied by investigating its effect on the one electron spectra by testing the predictions of Mahan, Nozieres and de Dominicis (MND) of how the many electron response to the core hole perturbation would modify the X-ray spectra near threshold. Both the one electron spectra and the parameters of the MND theory were evaluated using the scattering states found for the self-consistent potentials. Dissert. Abstr.

N79-19884 California Univ., Los Angeles.
DYNAMICS OF DILUTE MAGNETIC ALLOYS AND NON-EQUILIBRIUM SUPERCONDUCTIVITY: 1. THE ELECTRON SPIN RESONANCE RESIDUAL LINEWIDTH OF ERBIUM SILVER ALLOYS. 2. FREQUENCY AND MAGNETIC FIELD EFFECTS IN THE SPIN GLASS MANGANESE SILVER. 3. MICROWAVE RADIATION EFFECTS ON SUPERCONDUCTING TUNNEL JUNCTIONS AND THE CRITICAL CURRENTS OF SUPERCONDUCTING THIN FILMS Ph.D. Thesis
Earl Dan Dahlberg 1978 137 p
Avail: Univ. Microfilms Order No. 7906163

Three contributions to the residual linewidth of erbium dissolved in silver are (1) dipole-dipole interaction between the erbium moments; (2) the charge difference of an impurity ion in the silver lattice; and (3) strains in the silver lattice. Measured temperatures of the minimum and maximum in the susceptability of the spin glass silver manganese are determined and discussed. Both photon induced tunneling and classical rectification were observed in tunnel junctions following microwave radiation. The application of microwave radiation on superconducting thin films increased the critical current of the strips with the microwave coupling more efficiently to the superconductor for the geometries served. This increase in the critical current was found to be proportional to the square root of the incident microwave power. A.R.H.

N79-19885 Nebraska Univ. - Lincoln.
RAMAN SCATTERING FROM LAYERED COMPOUNDS Ph.D. Thesis
James Roy Duffey 1978 127 p
Avail: Univ. Microfilms Order No. 7906223

Raman spectroscopy has been used to study the layered transition metal dichalcogenides. When in the commensurate-charge-density-wave state, IT-TaS2 and 1T-TaSe2 both show complex Raman spectra. To a first approximation, the observed peaks arise because of the large crystalline unit cell induced by the charge-density wave. Raman spectra taken in the incommensurate phases of 1T-TaS2 and 1T-TaSe2 show only broad and unresolved peaks in the vicinity of 70 cm/1. The Raman spectrum of the 4Hb polytypes, in the region where a charge-density wave exists in the octahedral layers while the trigonal-prismatic layers are normal, is similar to the Raman spectrum in the 1T polytypes. There are some minor modifications apparently due to the changed interlayer coupling. The Raman spectra of 2H-NbSe2 and iron-doped 2H-TaSe2 taken at temperatures where these materials do not exhibit a charge-density-wave state. The

observed phonon energies were used in a simple lattice dynamical calculation. Dissert. Abstr.

N79-19886 Purdue Univ., Lafayette, Ind.
LOW TEMPERATURE SPECIFIC HEAT OF NIOBIUM-DOPED RUTILE (TiO2), THE VANADIUM MAGNELI PHASES Ph.D. Thesis
Gul Dad Khan Khattak 1978 99 p
Avail: Univ. Microfilms Order No. 7905736

In the absence of a magnetic field excess zero field specific heat of a single crystal of a niobium-doped rutile sample initially increases exponentially with temperature, shows a rounded maxima centered at approximately 1.3 K and then becomes almost independent of temperature. On applying a magnetic field the specific heat increases further and this magnetic specific heat exhibits a Schottky anomaly. At temperatures below 1K, the specific heats of single crystals of the vanadium Magneli phases v sub n O2 sub 2 n 1 phases are dominated by a nuclear contribution which allows the determination of the number of single and paired V 3+ and V+ ions. Dissert. Abstr.

N79-19887 California Univ., Irvine.
TEMPERATURE DEPENDENCE OF THE ELECTRONIC RELAXATION TIME IN COPPER, ALUMINUM, AND POTASSIUM DETERMINED FROM CHANGES IN THE SURFACE IMPEDANCE AT LOW TEMPERATURES Ph.D. Thesis
David Paul Love 1978 307 p
Avail: Univ. Microfilms Order No. 7906402

By varying the temperature of a thermally isolated metallic sample suspended within the coil of an extremely stable isothermal LC oscillator, changes in frequency are associated with the temperature dependence of the sample's surface impedance. At ordinary temperatures, the electronic mean-free-path is much less than the depth of penetration of the ac fields. Here the sample is said to exhibit the classical skin effect where local electrodynamics apply. At low temperatures, the electronic mean-free-path can be greater than the dept of penetration by the ac fields even at frequencies near 1 MHz, which are applicable here. When this is the case, the sample is said to exhibit the anomalous skin effect where non-local electrodynamics apply. The tunnel diode oscillator technique is described. Results for three metal samples are presented. Dissert. Abstr.

N79-19888 Wisconsin Univ. - Madison.
MEASUREMENTS OF THE DIAMAGNETIC ZEEMAN SHIFT IN BARIUM AND THE QUASI LANDAU SPECTRUM IN BARIUM AND STRONTIUM Ph.D. Thesis
Raymond John Fonck 1978 160 p
Avail: Univ. Microfilms Order No. 7822251

The diamagnetic Zeeman effect was isolated by observing the energy shifts of the 6 sns 1S0 Rydberg levels of barium in the presence of strong magnetic fields. The measured shifts of the 6sns 1S0 levels agree with hydrogenic first-order perturbation theory whenever configuration mixing is negligible. Perturbation of the Rydberg series by the 5d7d configuration reduces the shift below the hydrogenic value near n = 18. Magnetically induced configuration mixing between the 6sns 1S0 and 6snd 1D2 levels causes an enhancement in intensity of the higher members of the 1S0 series and diviations of the shifts from the hydrogenic values. Quasi Landau resonances were observed near the first ionization threshold in the M=0 even-parity spectra of barium and strontium using two-photon ionization spectroscopy. The positions of the resonances as a function of magnetic field strength are reported. Dissert. Abstr.

N79-19889 Stanford Univ., Calif.
SPIN-LATTICE RELAXATION OF DILUTE SOLUTIONS OF POLARIZED He-3 IN LIQUID He-4 IN LOW MAGNETIC FIELDS AT 4K, PART 1. AN ANALYSIS OF A PROPOSED CRYOGENIC He-3 NUCLEAR GYROSCOPE AND ITS APPLICATION TO A NUCLEAR ELECTRIC-DIPOLE MOMENT EXPERIMENT Ph.D. Thesis
Michael Allan Taber 1978 235 p
Avail: Univ. Microfilms Order No. 7905935

Measurements were made of the spin-lattice nuclear relaxation time of 0.07% solutions of polarized helium-3 in liquid helium-4 at 4 k by use of an rf-biased SQUID (Superconducting Quantum Interference Device) magnetometer in magnetic fields ranging between 30 microGauss and 3 milliGauss. As a potential application, the performance of a proposed cryogenic nuclear gyroscope utilizing a helium-4 - polarized helium-3 gas mixture with SQUID magnetometer readout in zero magnetic field is theoretically analyzed. The possibility of using a modified version of this device based on a polarized helium-3 - superfluid helium-4 mixture for the purpose of an experimental search for an electric-dipole moment in the helium-3 nucleus is also discussed. Dissert. Abstr.

N79-19890 Stanford Univ., Calif.
DEFECTS IN ANNEALED Al SUB XGa1-SUB XAs SINGLE CRYSTALS Ph.D. Thesis
Kou-I Chang 1978 86 p
Avail: Univ. Microfilms Order No. 7905828

The photoluminescent bands observed in the converted surface layers of aluminum gallium arsenide single crystals are due to both deep and shallow acceptors. Two prominent bands located at 1.53 and 1.46 eV, independent of Al composition x are discussed. Transient capacitance techniques were used to study the nonradiative defects in both as-grown and annealed samples. A hole trap, introduced by annealing was observed 0.42 eV above the top of the valance band is independent of x. A model is given to support the view that the Ga vacancies are hole traps and As vacancies are electron traps. Dissert. Abstr.

N79-19891 Cincinnati Univ., Ohio.
EXPLORATION OF NEW SCHEMES OF EXTRINSIC IR PHOTODETECTION USING DEEP IMPURITIES IN SILICON PLANAR CONFIGURATIONS Ph.D. Thesis
Shang-Bin Ko 1978 200 p
Avail: Univ. Microfilms Order No. 7904745

A MIR (multiple internal reflection) photoconductor and an infrared sensing MOSFET were investigated experimentally and theoretically to determine (1) the optical characteristics of extrinsic silicon photoconductors using deep impurities, (2) the use of the MIR technique for a high quantum efficiency infrared detector, and (3) the trade-off between the MIR photoconductor and the MOSFET. A diffusion technology which utilizes the source isolation method was developed for gold diffusion in silicon for the prototype MIR photoconductor. The quantum efficiency of the MIR photoconductor was found to be 0.34, which is about five times higher than the conventional photoconductor. The peak of the MOSFET photo spectrum appears at 1.35 micron (0.918 ev) which is close to the peak given by the MIR photoconductor. Dissert. Abstr.

N79-19892 California Univ., Los Angeles.
PLASTIC DEFORMATION OF ORDERED AND DISORDERED Cu3Au SINGLE CRYSTALS CONTAINING SILICA PARTICLES Ph.D. Thesis
Suryanarayan Pattanaik 1978 242 p
Avail: Univ. Microfilms Order No. 7906190

Alloy single crystals of Cu3Au containing 0.044, 0.089 and 0.179 wt% Si were internally oxidized to produce dispersions of spherical SiO2 particles. Compression samples, oriented for single slip on (111) (101), suitably heat-treated to have either an ordered or a disordered matrix, were tested in the range of temperatures 77-373 K to varying amounts of strains. The quenching stresses produced at the particles in the disordered alloy due to the differences in the thermal expansion coefficients of Cu3Au and SiO2 were observed to have a significant effect on the critical resolved shear stress. On the basis of observations it is concluded that the initial yield stress in both the disordered and the ordered Cu3Au-SiO2 alloys is controlled by the Orowan mechanism. The flow curves of disordered crystals exhibited three-stage work-hardening behavior at 295 K, but not at 77 K. Dissert. Abstr.

N79-19893 Vermont Univ., Burlington.
EXOELECTRON-LIKE BEHAVIOUR IN ULTRAVIOLET PHOTOELECTRON SPECTROSCOPY OF VACUUM QUENCHED POLYCRYSTALLINE MOLYBDENUM Ph.D. Thesis
James David Chlipala 1978 260 p
Avail: Univ. Microfilms Order No. 7901811

A digital electronic process controller was fabricated to effect ultraviolet photoelectron spectroscopy (UPS) measurements

of polycrystalline molybdenum in ultrahigh vacuum. The resultant experimental system was interfaced to a multiple computer network. Total photocurrent measurements of the same material were also taken and a Fowler Curve analysis was performed. The UPS measurements revealed time dependent data structure unexpected for equilibrium polycrystalline molybdenum. The anomalous behavior was correlated with a vacuum quench procedure. Similarity between the measured effect and exoelectron emission (EE) was suggested. Various existing theories of EE were considered for data explanation but rejected for a number of reasons. A model for the data behaviour was developed based on trapped surface electrons and inelastic scattering between primary photoelectrons and the localized electrons.
Dissert. Abstr.

N79-19894 Oklahoma State Univ., Stillwater.
LASER SPECTROSCOPY STUDIES OF ENERGY TRANSFER IN YVO4:Eu-3PLUS, Er-3 PLUS Ph.D. Thesis
George E. Venikouas 1978 106 p
Avail: Univ. Microfilms Order No. 7903756

Host-sensitized energy transfer in yttrium vanadate crystals doped with trivalent rare earth impurity ions at low temperatures is consistent with a single step electric dipole-dipole interaction process from self-trapped excitons, whereas at high temperatures the transfer is dominated by thermally activated exciton hopping with activator induced host traps having an important part in the trapping process. Three major types of crystal field sites are observed for Eu(3+) ions in YVO4 crystals and energy transfer takes place among the ions in these different types of sites by a single step, electric dipole-dipole interaction process. The values of the critical interaction distances of the order of 8A are much smaller than the average separation of uniformly distributed europium ions of 25A in a sample containing 1.0% Eu(3+). This indicates that the europium ions in different sites are tending to form clusters.
Dissert. Abstr.

N79-19895 Missouri Univ. -Rolla.
AN INVESTIGATION OF REACTIONS AT A PLATINUM-GALLIUM-ARSENIDE INTERFACE Ph.D. Thesis
David Lawrence Begley 1978 101 p
Avail: Univ. Microfilms Order No. 7904329

The propagation characteristics of surface electromagnetic waves in the far-infrared were investigated for the metal-air, GaAs-air, and GaAs-Pt-air systems. The reaction at the Pt-GaAs interface do to annealing was investigated utilizing optical reflection and transmission spectroscopy, secondary ion mass spectroscopy, X-ray diffractometry, scanning electron and ion microscopy, X-ray energy spectroscopy, and Auger spectroscopy.
Dissert. Abstr.

N79-19896 California Univ., Berkeley.
PLASTIC DEFORMATION OF CRYSTALS: ANALYTICAL AND COMPUTER SIMULATION STUDIES OF DISLOCATION GLIDE Ph.D. Thesis
Sabri Altintas 1978 151 p
Avail: Univ. Microfilms Order No. 7904361

The planar glide of a dislocation through randomly distributed obstacles is considered. The critical resolved shear stress for athermal glide and the velocity of the dislocation at finite temperature as a function of the applied stress and the nature and strength of the obstacles are calculated. Dislocation glide through mixtures of obstacles were studied analytically and by computer simulation. Arrays containing two kinds of obstacles as well as square distribution of obstacle strengths are considered. The critical resolved shear stress for an array containing obstacles with a given distribution of strengths is calculated using the sum of the quadratic mean of the stresses for the individual obstacles and is found to be in good agreement with the computer simulation data.
Dissert. Abstr.

N79-19897 Pennsylvania State Univ., University Park.
SMALL-ANGLE X-RAY STUDIES ON POLYMER SINGLE CRYSTAL SUSPENSIONS Ph.D. Thesis
Jing-I Wang 1978 146 p
Avail: Univ. Microfilms Order No. 7902668

Small angle X-ray scattering from oriented mats and random suspensions of polyethylene crystals were studied. The radius of gyration of lamellae crystals were directly determined. The apparent radius of gyration of the same crystals in different suspension liquids (xylene, hexane) depends on the liquid used. This implies that either polyethylene crystals are not homogeneous and/or there are some interactions between the liquids and crystals. Directly calculating lamellar thickness from the apparent radius of gyration one does not obtain the true lamellar thickness. In order to obtain the true thickness of the lamellae, the Guinier equation was modified and derived to accommodate the two-phase nature of polymer lamellae. Using this approach the true overall lamellae thickness and the thickness of the crystalline core of the lamellae are determined from diffuse small-angle X-ray data.
Dissert. Abstr.

N79-19898 Oklahoma State Univ., Stillwater.
MAGNETIC RESONANCE STUDY OF POINT DEFECTS IN KMgF3 AND RbMgF3 Ph.D. Thesis
Kanan Bihari Saha 1978 94 p
Avail: Univ. Microfilms Order No. 7903741

An electron nuclear double resonance (ENDOR) investigation of F centers in KMgF3 and an electron spin resonance (ESR) investigation of V sub K centers in RbMgF3 were made. Samples were irradiated with 1.5 MeV electrons from a Van de Graaff accelerator at room temperature and at 77 K. The ENDOR and ESR measurements of radiation-induced point defects were performed using an X-band homodyne ENDOR-ESR spectrometer. A characterization of the V sub K center in RbMgF3 was made by measuring the decay temperature and hyperfine interaction parameters.
Dissert. Abstr.

N79-19899 Northwestern Univ., Evanston, Ill.
SHAPE VARIATION, APPARENT GROWTH RATE, AND AGGLOMERATION IN SUSPENSION CRYSTALLIZATION Ph.D. Thesis
Peter Fang-Der Liao 1978 150 p
Avail: Univ. Microfilms Order No. 7903311

Various means of characterizing crystal size, methods of analysis, and experimental factors are studied with a view to accounting for the size and shape dispersion in batch crystallization as well as the deviation from exponential size distribution in a continous MSMPR crystallizer. It is concluded that although experimental data of crystal size distribution are important in evaluating and analyzing the performance of crystallizers, attaching a definitive interpretation to them represents a very difficult task. Affirmative results can often be obtained for the model chosen. To further discriminate the different models in the hope to really comprehend the underlying mechanisms requires much more information, which can come from either the same experiments or supplementary experiments, other than just the crystal size distribution.
Dissert. Abstr.

N79-19900 College of William and Mary, Williamsburg, Va.
THEORY OF SOLID STATE MUON SPIN ROTATION OR RELAXATION EXPERIMENTS: POSITIVE MUON HYPERFINE FIELDS AND TRAP-LIMITED SPIN DEPOLARIZATION Ph.D. Thesis
Ram Lal Munjal 1978 108 p
Avail: Univ. Microfilms Order No. 7904280

Based upon the spin density functional formalism, a full self-consistent calculation of the positive muon Knight shift in Na, Li, K, Rb, Cs, and Cu was carried out. The same formalism was used to calculate the contact hyperfine field of a positive muon in Ni. A model was proposed in which the screening of the muon charge is done by free electrons of an essentially unpolarized 4s band, while the hyperfine field is due mainly to the relatively unperturbed 3d spin density arising from the different radial character of the majority and minority spin 3d wave functions. A nonequillibrium theory of motional narrowing appropriate when positive muon diffusion traps occurs was also formulated.
Dissert. Abstr.

N79-19901# Royal Aircraft Establishment, Farnborough (England).
MECHANICAL PROPERTIES AND CLEAVAGE FRACTURE OF IRON SINGLE CRYSTALS AT 77 K
F. Terasaki Mar. 1978 31 p refs Transl. into ENGLISH from Acta Met. (New York), v. 15, 1967 p 1057-1072
(RAE-Lib-Trans-1924) Avail: NTIS HC A03/MF A01

Single crystals of good purity iron with various crystallographic

orientations were tested in tension at 77 K. The stress-strain curves were analyzed and the variation of mechanical properties and fracture mode with the orientation of the tensile axis is discussed. The experimental results are examined in the light of the most important models which are generally considered for cleavage fracture initiation. When the load is applied along the (001) axis, the deformation of the specimens occurs by twinning and the fracture by cleavage which is obtained is associated with the presence of these twins. The specimens having their axis orientated along a (110) direction fail in a ductile manner. The fracture mode of these specimens can only be explained in terms of Cottrell type dislocations. When the tensile axis is parallel to the (111) direction the results are more difficult to interpret: almost all models are in agreement with the observed behavior of the specimens, but the exact conditions of cleavage initiation are such that no definite conclusions can be drawn. L.P.

N79-19902# Colorado State Univ., Fort Collins. Dept. of Physics.
ELECTRONIC PROFILE OF N-InAs ON SEMI-INSULATING Ga-As
H. A. Washburn, J. R. Sites, and H. H. Wieder 20 Oct. 1978 31 p refs
(Contract N00014-76-C-0976)
(AD-A061685; SF15) Avail: NTIS HC A03/MF A01 CSCL 20/12

Electron density and mobility are measured in three regions of InAs epilayers on GaAs substrate: (1) The interfacial layer shows an increase in density and decrease in mobility over a 3 micron distance; (2) the bulk of the epilayer has n approx. 1/10 to the 16th power cc, mu approx. 100000 sq. cm/V-sec; and (3) the front surface, accumulated at zero bias, displays surface quantization effects and an enhanced effective mass.
Author (GRA)

N79-19903# Connecticut Univ., Storrs. Dept. of Physics.
THEORETICAL INVESTIGATIONS OF COLOR CENTERS IN ALKALI AZIDES Final Report, 15 Mar. 1975 - 14 Jun. 1978
Ralph H. Bartram 25 Sep. 1978 21 p refs
(Grant DAHC04-75-G-0128)
(AD-A062059; ARO-13262.9-P; FR-25) Avail: NTIS HC A02/MF A01 CSCL 20/2

Ab-initio molecular orbital calculations were performed on N4(-) in KN3 and the azide ion (N3(-)) in order to facilitate interpretation of optical absorption, ESR and fluorescence spectra. Newly discovered defects include interstitial N2(-) and substitutional NH2 in uv-irradiated NaN3. Author (GRA)

N79-19904# Varian Associates, Palo Alto, Calif. Solid State Lab.
BASIC IMPROVEMENTS IN SUBSTRATE InP MATERIAL Final Report, 1 Feb. 1976 - 31 Jul. 1978
G. A. Antypas Oct. 1978 17 p refs
(Contract DAAG29-76-C-0015)
(AD-A061873; ARO-13601.4-ELX) Avail: NTIS HC A02/MF A01 CSCL 20/2

Extremely high purity polycrystalline InP was prepared from solution, having background carrier concentration of 4 x 10 to the 14th power and mobility at 77 K greater than 90,000. When this material is used for the growth of undoped single crystal it results in N sub D-N sub A = 1 x 10 to the 15th power/cc and mobility = 53,000. Low temperature PL also indicates both materials to be of extremely high purity. Preliminary results indicate that doping of single crystal InP by Sn, Fe and particulary Zn result in improved defect density. Author

N79-19905# Colorado State Univ., Fort Collins. Dept. of Physics.
SILICON NITRIDE LAYERS ON GALLIUM ARSENIDE BY LOW ENERGY ION BEAM SPUTTERING
L. E. Bradley and J. R. Sites 1 Oct. 1978 21 p refs
(Contract N00014-76-C-0976)
(AD-A061652; SF14) Avail: NTIS HC A02/MF A01 CSCL 11/2

Low energy ion beam sputtering with argon was used to deposit layers of Si3N4 onto GaAs for encapsulation purposes. Mechanical stability to above 900 C has been achieved; silicon diffuses into the GaAs at 600 C and above; index of refraction is a simple, but reliable test of encapsulant quality.
Author (GRA)

N79-19906# Newcastle-upon-Tyne Univ. (England). Dept. of Electrical and Electronic Engineering.
NEW PASSIVATION METHODS OF GaAs Final Technical Report, 28 Jan. - 27 Sep. 1978
B. Bayraktaroglu, P. A. Breeze, A. Colquhoun, A. F. A. B. El-Safti, and S. J. Hannah Sep. 1978 39 p
(Grant DA-ERO-78-G-030)
(AD-A061954) Avail: NTIS HC A03/MF A01 CSCL 20/12

Further detailed ESCA studies are reported on native oxide MOS structures with and without the incorporation of Al2O3. The anodic oxidation of InP was investigated from an electrolyte point of view. The oxide growth mechanism involving electrolytic oxidation of sandwiches of Al and Ge were studied by using GaAs as a substrate. An attempt was made to formulate a simple electrical model of GaAs MOS diodes which fits reasonably well with experimental C-V and G-V characteristics. The development of further GaAs MOS transistors is reported: in particular charge storage MAOS transistors were measured. Finally, the d.c. emission of white light from thin GaAs MOS structures is reported. The spectral distribution of this emission seems to indicate that either a substantial contribution is obtained by the recombination of electrons and holes in the amorphous oxide (whose energy gap is larger than that of GaAs) or by direct recombination of hot charge carriers in the space charge layer. Author (GRA)

N79-19907# City Univ. of New York. Dept. of Physics.
INVESTIGATION INTO SELECTED PROBLEMS IN SOLID STATE PHYSICS Final Report, 1 Sep. 1974 - 31 Aug. 1978
Joseph L. Birman and Henry Semat Nov. 1978 12 p refs
(Grant DAHC04-75-G-0052; DAAG29-78-G-0021)
(AD-A062076; ARO-12665.2-P) Avail: NTIS HC A02/MF A01 CSCL 20/12

During the period of the grant advances were made in the theory of nonlocal optics (spatial dispersion phenomena) in solids including prediction of new phenomena in transient optics: precursors, transient reflectivity, altered signal velocity. Surface related optical properties including lateral displacement, selective total internal reflection were investigated. All the above relate to exciton-mediated optical properties of insulators and semiconductors. New optical phenomena related to morphic effects (stress related) were determined. New electronic models for properties of the A-15 compounds were proposed - with quantitative agreement with experiment. A random stacking model for structure of amorphous tetrahedral semiconductors was proposed and tested. A two phonon Raman Scattering feature in diamond was identified as an overtone. GRA

N79-19908# National Bureau of Standards, Washington, D. C. Electron Devices Div.
THEORY AND APPLICATION OF A TWO-LAYER HALL TECHNIQUE Final Report, 3 Apr. - 30 Sep. 1978
R. D. Larrabee and W. R. Thurber Oct. 1978 29 p refs Sponsored in part by Army Night Vision Lab.
(PB-288763/6; NBSIR-78-1553) Avail: NTIS HC A03/MF A01 CSCL 20L

A modification of the conventional Hall technique was developed in which the Hall measirements are made simultaneously on the epitaxial layer and its substrate; the interface impedance is measured; and the interaction between the two regions is modeled and taken into account. This technique can be used not only to measure the unperturbed resistivity and Hall coefficient of each layer separately, but also to verify those cases in which the perturbing effects of a high resistivity substrate are negligible, thus justifying conventional measurements on the epitaxial layer. This technique was used to measure the parameters of an n-type indium-doped silicon epitaxial layer on a bulk-grown p-type indium-doped substrate. The results suggest that the major n-type dopant in this specimen has a density of about 1 x 10 to the 17th power/cc and an apparent activation energy of about 45 meV. Similar data were obtained on a second epitaxial layer grown on a high resistivity undoped substrate. These results argue strongly for the presence of one or more undesired sources

of shallow donor contamination in the epitaxial growth system used to produce these specimens. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N79-19909 California Univ., Los Angeles.
THE BEHAVIOR OF SUPERFLUID He II DURING THE LAMBDA TRANSITION FROM He II TO He I AND POST TRANSITION PHENOMENA IN THE PRESENCE OF HEAT AND MASS FLOW Ph.D. Thesis
Shlomo Caspi 1978 174 p
Avail: Univ. Microfilms Order No. 7906158

Heat flow measurements were performed in He 2 at pressures above the thermodynamic critical pressure. Two types of geometry were used: a U - tube geometry heat from below; a rectangular formvar coated composite superconductor internally heated. Above the thermodynamic critical pressure the samples were energized until the local He 2 layer at the heater vicinity underwent a transition to He 1. The heat flux density associated with this transition was measured for an initial bath temperature (T = T sub b) between 1.6 K and 2.124 K, and pressures between 2.4 bar and 10.8 bar. Dissert. Abstr.

N79-19910 College of William and Mary, Williamsburg, Va.
SEMICLASSICAL CALCULATION OF VIBRATIONAL ENERGY LEVELS FOR NONSEPARABLE SYSTEMS Ph.D. Thesis
Randall Thomas Swimm 1978 151 p
Avail: Univ. Microfilms Order No. 7904276

For a Hamiltonian written as a power series in which the leading terms are given by a sum of one-dimensional harmonic oscillator Hamiltonians representing an unperturbed limit of the full Hamiltonian, the original classical Hamiltonian is transformed via a succession of canonical transformations into a normal form, which is a power series. Once the normal form is obtained, semiclassical quantization of action variables is straightforward. The incommensurable case yields a formula for the energy spectrum which is a power series in the quantum numbers. The commensurable case is more complicated, and yields a form from which energy levels may be obtained individually by numerical calculation and quantization of a one-dimensional phase integral. Non-separable two-dimensional examples are treated for each case. The results obtained for both cases show excellent agreement with quantum mechanical calculations. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N79-19911*# National Aeronautics and Space Administration, Washington, D. C.
ELEMENTARY SCHOOL AEROSPACE ACTIVITIES: A RESOURCE FOR TEACHERS
1977 35 p refs Prepared by Nebraska Univ. -Lincoln
(NASA-EP-147) Avail: NTIS MF A01; HC SOD CSCL 05I

The chronological development of the story of man and flight, with emphasis on space flight, is presented in 10 units designed as a resource for elementary school teachers. Future exploration of space and the utlization of space flight capabilities are included. Each unit contains an outline, a list of suggested activities for correlation, a bibliography, and a list of selected audiovisual materials. A glossary of aerospace terms is included. Topics cover: earth characteristics that affect flight; flight in atmosphere, rockets, technological advances, unmanned Earth satellites, umanned exploration of the solar system, life support systems; astronauts, man in space, and projections for the future. A.R.H.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-19912*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MANAGEMENT SYSTEM, ORGANIZATIONAL CLIMATE AND PERFORMANCE RELATIONSHIPS
Bervil D. Davis Feb. 1979 38 p refs
(NASA-TP-1417; M-281) Avail: NTIS HC A03/MF A01 CSCL 05A

Seven aerospace firms were investigated to determine if a relationship existed among management systems, organizational climate, and organization performance. Positive relationships were found between each of these variables, but a statistically significant relationship existed only between the management system and organizational climate. The direction and amount of communication and the degree of decentralized decision-making, elements of the management system, also had a statisticallly significant realtionship with organization performance. Author

N79-19913# Washington Univ., Seattle. Dept. of Psychology.
THE CONTINGENCY MODEL FOR THE SELECTION OF DECISION STRATEGIES: AN EMPIRICAL TEST
Daniel W. McAllister, Terence R. Mitchell, and Lee Roy Beach Oct. 1978 25 p refs
(Contract N00014-76-C-0193)
(AD-A061904; TR-78-17) Avail: NTIS HC A02/MF A01 CSCL 12/2

A contingency model for the selection of decision strategies was described and tested. This model suggests that when decisions are more significant, the decision cannot be reversed, and the decision maker is responsible for his actions, then the decision strategy will be more analytic and result in a greater investment of time and effort than when the opposite conditions are true. Three studies tested and supported these assumptions. The results are discussed in terms of their implications for the further development of this particular model and for the field of decision making in general. Author (GRA)

N79-19914# Purdue Research Foundation, Lafayette, Ind.
ENHANCING PRODUCTIVITY THROUGH FEEDBACK AND JOB DESIGN Final Report, 1 Oct. 1976 - 31 Dec. 1977
Robert D. Pritchard, Raymond V. Montagno, and John R. Moore Aug. 1978 47 p refs
(Contract F33615-77-C-0026)
(AD-A061703; AFHRL-TR-78-44) Avail: NTIS HC A03/MF A01 CSCL 05/10

This research represents a study in a program to investigate potential sources of the intrinsic motivation of Air Force personnel. The first step in this process was an attempt to identify and list a number of sources of intrinsic motivation. From this list, feedback and job design were selected as sources that held promise for use in Air Force type settings. This report describes an attempt to manipulate several dimensions of feedback and the degree to which a person did a complete unit of work. A job simulation was employed to experimentally test the variables finally selected. The criteria for the task used in the simulation were that it have generalizability to the Air Force and that it possess acceptable face validity for the subjects participating in the study. The task used in this study involved the processing of purchase requisitions and was designed so that subjects believed they were working on a real job and so that there was distinct quantity and quality dimensions that could be measured. The results of the study indicated that feedback has great potential for improving productivity. However, different types of feedback had markedly different effects. The best type of feedback in this study was Impersonal, High Specificity, Individual feedback in either the Public or Private format. This combination of feedback resulted in a 26% increase in quantity and a 27% decrease in errors.
Author (GRA)

N79-19915# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A MANAGEMENT INFORMATION SYSTEM TO ESTIMATE

CONTROLLED MATERIALS REQUIREMENTS FOR AIR FORCE CONTRACTS M.S. Thesis
Thomas F. Pustis and David J. Wallace Jun. 1978 142 p refs
(AD-A061707; AFIT-LSSR-24-78A) Avail: NTIS HC A07/MF A01 CSCL 05/1

The purpose of the thesis effort was to plan and design a management information system for the Joint Aeronautical Materials Activity (JAMAC). The developed system generates materials requirement estimates for controlled materials used during performance of United States Air Force contracts. Controlled materials requirements for such contracts are prepared for seven program identification codes (A-1, A-2, A-6, A-7, C-2, C-3, and C-9) as established by the Defense Materials System. The computer program used to generate the requirements makes use of matrix algebra routines. System output includes the materials requirement estimates for each program identification code and accuracy/audit lists Author (GRA)

N79-19916# General Accounting Office, Washington, D. C. International Div.
FOREIGN-SOURCE PROCUREMENT FUNDED THROUGH FEDERAL PROGRAMS BY STATES AND ORGANIZATIONS
30 Nov. 1978 81 p refs
(PB-288823/8; ID-79-1) Avail: NTIS HC A05/MF A01 CSCL 05A

Foreign-source procurement funded through Federal programs by states and selected organizations is addressed. Legislation enacted this year at both the state and Federal levels considerably expands buy-national preferences for U.S. firms competing for such federally financed procurement. Federal and state buy-national preferences are identified and legal issues relating to state and local buy-national preferences are defined. Information on foreign-source procurement by states and organizations is provided for federally assisted highway, urban mass transportation, railroad, airport, municipal wastewater treatment, local public works, and rural electrification programs. GRA

N79-19917# American Univ., Washington, D. C.
FINANCIAL MANAGEMENT IN THE FEDERAL GOVERNMENT: A TREASURY PERSPECTIVE Final Report
James J. Lucas 18 Aug. 1978 106 p refs Sponsored in part by Bureau of Gov. Financial Operations, Wash., D. C.
(PB-288819/6; AU/IAPFM-24-77-3) Avail: NTIS HC A06/MF A01 CSCL 05A

The mechanics of the Treasury Department's central accounting and reporting system, are explained in order to: (1) create an awareness of the interrelationships that exist in the Federal financial community; (2) encourage greater government-wide cooperation in Treasury's objective to publish timely and accurate financial reports; and (3) reduce the incidence of reporting and communications problems which hinder the accomplishment of that objective. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N79-19918 Purdue Univ., Lafayette, Ind.
A PLANNING MODEL FOR THE FINANCING OF INFORMATION CENTERS, VOLUME 1 AND 2 Ph.D. Thesis
David Leslie Levy 1978 627 p
Avail: Univ. Microfilms Order No. 7905743

The method presented here as an aid to managers is that of computerized planning models. The models developed here is called the Information Center Management Systems, ICMS, model. This model is a mangement tool designed to assist in the information center financial of a simulated information center. This simulated center can be the existing one incorporating policy changes, or one just starting operations. The ICMS model allows for the treament of the various aspects of financial management to be included in the performance analysis of the simulated centers. The ICMS model also provides the new information center manager with an instrument for learning about the financial management process and at the same time providing him an aid for financial management decisions. Dissert. Abstr.

N79-19919# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.
AN INTRODUCTION TO DESIGN OPTIMALITY WITH AN OVERVIEW OF THE LITERATURE Interim Report
A. Ash and A. Hedayat Aug. 1978 36 p
(Grant AF-AFOSR-3050-76)
(AD-A061902; AFOSR-78-1455TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

A brief introduction of optimal design theory is given for those who are not familiar with the subject. A list of 312 selected articles on the theory of optimal design is provided. The bibliography however should be sufficiently thorough to be of use to researchers in the field. Author (GRA)

N79-19920# Industrial Innovation Coordinating Committee, Washington, D. C. Advisory Committee on Industrial Innovation.
INFORMATION POLICY: DRAFT REPORT
20 Dec. 1978 56 p
(PB-290404/3) Avail: NTIS HC A04/MF A01 CSCL 05B

The Subcommittee sought to identify areas where information is used in innovation. Six areas were studied in some depth after reviewing a much broader scope of actual or potential Government involvement: (1) patents as a source of information; (2) foreign market and technical information; (3) assistance to users; (4) regulatory impediments, including the Freedom of Information Act; (5) protection of data bases and software; and (6) government as a creator and distributor of information. GRA

N79-19921# Industrial Innovation Coordinating Committee, Washington, D. C.
PUBLIC SYMPOSIUM ON INFORMATION
25 Jan. 1979 182 p Symp. held at Wash., D. C., 25 Jan. 1979
(PB-290418/3) Avail: NTIS HC A09/MF A01 CSCL 05B

The report consists of the minutes of a meeting held at the Department of Commerce on January 25, 1979. Representatives of government agencies, industry, labor unions, and universities were present. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N79-19922 Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1979, PART 3
Washington GPO 1978 189 p refs Hearings on S. 2527 before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 2d Sess., 8 and 16 Mar. 1978
(GPO-25-603-PT-3) Avail: Subcomm. on Sci., Technol., and Space

The policy basis of U.S. cooperation with other nations in space projects and technology applications is reviewed. Highlights

of current and planned reimbursable services and cooperative activities are summarized. The feasibility of a joint shuttle/Salyut mission and cooperation with the U.S.S.R., Canada, and France in a satellite-aided search and rescue demonstration project are examined. Shuttle utilization by DOD and other Defense Department activities of interest to NASA are discussed. A.R.H.

N79-19923 Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1979, PART 2
Washington GPO 1978 418 p refs Hearings on S. 2527 before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 95th Congr. 2d Sess., 1 and 7 Mar. 1978
(GPO-25-603-PT-2) Avail: Subcomm. on Sci., Technol., and Space

Activities of NASA's Office of Space and Terrestrial Applications are described in support of funding requests. Testimony in response to specific questions related to technology utilization and transfer are included with illustrations of the slides used in the presentations. The need to fund innovative and creative educational programs to support growing student interest in space exploration is addressed by representatives of the Forum for the Advancement of Students in Science and Technology. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N79-19924 California Univ., Berkeley.
A MODEL FOR THE SWING-HAMMERMILL SIZE REDUCTION OF RESIDENTIAL REFUSE Ph.D. Thesis
Geoffrey Ross Shiflett 1978 163 p
Avail: Univ. Microfilms Order No. 7904351

The size discrete-time continuous lumped parameter model developed by the mineral processing industry to describe ball or rod milling was adapted for use with a closed circuit hammermill system. A short survey of comminution and solid waste processing literature is given and the equations for the model are presented. Differences between the ball or rod milling homogeneous brittle materials and the hammermilling of refuse are discussed and the necessary modifications made in use of the model. Relationships between the operating parameters of a refuse shredder are developed. The results of the experimental program indicate flow rate and holdup to be related by a power function and that mean residence time increases as the flowrate is raised. Power draw is shown to be a function of the holdup in the shredder and the moisture content of the refuse. Equations for the preceding relationships are developed through statistical analysis. An optimization program is used to relate the actual shredder operating variables to the major parameters of the computer model. Dissert. Abstr.

N79-19925 Massachusetts Univ., Amherst.
MATHEMATICAL MODE OF THE FLUIDIZED BED BIOFILM REACTOR Ph.D. Thesis
Leo Thomas Mulcahy 1978 281 p
Avail: Univ. Microfilms Order No. 7903811

The mathematical model has two major subdivisions. The first predicts biomass holdup and biofilm thickness within the reactor using drag coefficient and bed expansion correlations developed as part of this research. The second predicts mass transport-affected substrate conversion by biofilm covering individual support particles. The intrinsic kinetic coefficients and effective diffusivity for nitrate limited biofilm denitrification, used as input to this portion of the model, were determined in an independent study using a rotating disk biofilm reactor. Biomass holdup, biofilm thickness, and nitrate profiles observed in a laboratory fluidized bed biofilm reactor were compared with simulated results obtained using the mathematical model. Good agreement between observed and simulated results was obtained, with closest agreement obtained for biofilm thickness under 300 microns. Dissert. Abstr.

N79-19926 New Mexico State Univ., University Park.
EFFLUENT AND GAMMA-IRRADIATED DIGESTED SLUDGE ADDITIONS ON CALCAREOUS SOILS Ph.D. Thesis
Vicente Lee-Rodriguez 1978 148 p
Avail: Univ. Microfilms Order No. 7905671

The long-term use of sewage effluent and the use of gamma-irradiated treated digested sewage sludge (RDSS) were studied under field greenhouse conditions, respectively. The purpose of this investigation was to: (1) study the effect of long and short-term application of secondary sewage effluent and RDSS, respectively, and the buildup of iron and phytotoxicity problems on calcareous soils; (2) study the potential phytotoxicity of RDSS and ovserve the micronutrient fertilizer value of RDSS through three successive plantings on calcareous soil; and (3) evaulate RDSS as source of iron in a soil known to be severely iron-deficient. Dissert. Abstr.

N79-19927 Iowa Univ., Iowa City.
A MINIMAX PROCEDURE FOR THE STOCHASTIC TRANSPORTATION PROBLEM Ph.D. Thesis
Sei-Jong Chung 1978 154 p
Avail: Univ. Microfilms Order No. 7902886

The principal problem studied here is the optimal planning of shipments of a homogeneous commodity to the demand areas, where the demands are uncertain. Specifically, the general stochastic trnasportation model has m sources and n destinations. The amounts of shipment from the sources to the destinations are to be determined before the actual demands become known. When the demands are known, a recourse action can then be taken to amend any discrepancies between the actual amounts of shipments and the actual demands, but penalty costs will be attributed to them. The art in this problem is, therefore, how to determine beforehand optimal amounts of shipments to the destinations so that the penalty costs for discrepancies will be minimized. Dissert. Abstr.

N79-19928 Cornell Univ., Ithaca, N. Y.
THE ANAEROBIC ATTACHED FILM EXPANDED BED REACTOR FOR THE TREATMENT OF DILUTE ORGANIC WASTES Ph.D. Thesis
Michael Samuel Switzenbaum 1978 205 p
Avail: Univ. Microfilms Order No. 7902370

A process, the anaerobic attached film expanded bed reactor (AAFEB) has been found to be effective for the treatment of low strength soluble organic wastes anaerobically, at reduced temperatures, at short retention times, and at high organic loading rates. An analysis of the key process variables which affected AAFEB operation and two simplified first order equations relating the process efficiency to the net specific growth rate of the film and specific substrate utilization two widely used operational parameters which are based on fundamentals of microbial growth and energetics, are presented. Dissert. Abstr.

N79-19929 Lehigh Univ., Bethlehem, Pa.
THE DESIGN OF SOLID WASTE SYSTEMS: AN APPLICATION OF GEOMETRIC PROGRAMMING TO PROBLEMS IN MUNICIPAL SOLID WASTE MANAGEMENT Ph.D. Thesis
Wilson Winant Yale 1978 338 p
Avail: Univ. Microfilms Order No. 7904325

An attempt is made to development of nonlinear solid waste management models that more accurately approximate reality than previous attempts. Only cost minimization models are investigated. The nonlinear phenomena of economies of scale and diseconomies of scale pervade the cost structure of municipal solid waste models. Therefore, each mathematical model is a nonlinear programming problem which is solved by geometric programming. The nonlinear objective function models the fixed and variable costs of the solid waste system while the constraints impose technological, legal, and social restrictions upon the system. In general, the resulting geometric program can have reversed constraints, inactive constraints, and large degrees of difficulty. A solution procedure with a heuristic rule is developed

and then utilized to obtain solutions to the geometric programs. Dissert. Abstr.

N79-19930 Committee on Commerce, Science, and Transportation (U. S. Senate).
OVERSIGHT OF SCIENCE AND TECHNOLOGY POLICY, PART 2
Washington GPO 1978 309 p refs Hearings before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 10 Feb. and 26 Apr. 1976 (GPO-28-948) Avail: Subcomm. on Sci., Technol., and Space

The Presidents's objectives concerning science and technology are reviewed and the overall status of research and development in the U.S. is assessed. Particular areas of concern are opportunities for younger scientists in academic departments and the lag in productivity and the decline of industrial innovation. The allocation of funds among the stages, performers, and purposes of research and development is examined in relation to other government policies affecting the contribution of science and technology to the nation's needs. Articles, letters, and statements are included with the direct testimony. A.R.H.

N79-19931*# Kentucky Univ., Lexington. Center for Public Affairs.
NASA-UK STAP: A TECHNOLOGY APPLICATIONS PROGRAM TO AID GOVERNMENT AND INDUSTRY IN KENTUCKY Annual Report
1978 13 p Sponsored by NASA
Avail: NTIS HC A02/MF A01 CSCL 05A

There is a need for a well-defined partnership between universities, and the business and industrial community to promote the transfer of technology. In an effort to foster such a partnership, the Space Systems Program, administered by NASA, has established information dissemination centers in cooperation with various universities throughout the country. As a result of limited success in the transfer of technology to state and local units of government NASA felt that new stimuli and new approaches were needed in the public sector area. NASA selected the University of Kentucky, a land grant institution with a significant research dissemination and service role, as the site for the new program. An annual report of this program at the University of Kentucky is presented. G.Y.

N79-19932# Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
THE HAZARD RANKING AND ALLOCATION METHODOLOGY: EVALUATION OF TNT WASTEWATERS FOR CONTINUING RESEARCH EFFORTS Special Report, Feb. - Apr. 1978
M. J. Small Sep. 1978 75 p refs
(AD-A061770; USAMBRDL-TR-7808) Avail: NTIS HC A04/MF A01 CSCL 07/1

Research to characterize the acute toxic nature and the mutagenic activity of compounds present in the waste product from 2,4,6-trinit-rotoluene manufacture was reviewed. As part of this assessment, the Hazard Ranking and Allocation Methodology was performed on compounds of interest. This analysis is based on estimations of hazard and the quality of these estimates. The research allocation analysis was performed on 20 projects. They involved 10 compounds and 2 studies: (1)a lifetime mammalian study; and (2)an in-depth acute aquatic bioassay. The analysis indicated that any compound/acute aquatic bioassay project was favored over any compound/mammalian project. The stochastic characteristics of the methodology and how they impact the results were reviewed in depth. J.M.S.

N79-19933# Los Angeles County Sanitation District, Whittier, Calif.
TWO-STAGE GRANULAR ACTIVATED CARBON TREATMENT Final Report, Mar. 1970 - Dec. 1973
Leon S. Directo, Ching-lin Chen, and Robert P. Miele Sep. 1978 75 p refs
(Contract EPA-14-12-150)
(PB-288438/5; EPA-600/2-78-170) Avail: NTIS HC A04/MF A01 CSCL 13B

Two 6.31/sec (0.15 mgd), two-stage, packed-bed, downflow granular activated carbon pilot plants were operated continuously for 33 months using unfiltered and unchlorinated activated sludge plant effluent. The performance of granular carbons of different particle size was compared. The data collected has demonstrated the efficacy of the two stage carbon adsorptive system in consistently producing effluent of excellent overall quality. GRA

N79-19934# Pacific Northwest Environmental Research Lab., Corvallis, Ore. Marine and Freshwater Ecology Branch.
DISPERSION OF SEWAGE SLUDGE DISCHARGED INTO NEW YORK BIGHT. PHYSICAL OCEANOGRAPHIC DATA, DECEMBER 1974
A. M. Teeter, R. J. Callaway, and D. W. Denbo Sep. 1978 60 p
(PB-288421/1; EPA-600/3-78-086A) Avail: NTIS HC A04/MF A01 CSCL 13B

Physical oceanographic data collected at the sewage sludge disposal site near the apex of the New York Bight, December 18 through 21, 1974 are presented. An optical tracer method was used to measure the water column distribution of waste material with time after discharge. Profiles with depth were taken for two to four hours after waste discharge. Ambient temperature-salinity-density profiles and current measurements were also taken. GRA

N79-19935# Jordan (Edward. C.) Co., Inc., Portland, Maine.
PILOT SCALE EVALUATIONS OF SEPTAGE TREATMENT ALTERNATIVES Final Report, 1 Oct. 1976 - 31 Mar. 1978
Arthur J. Condren Sep. 1978 135 p refs Prepared for Maine Municipal Association, Augusta
(Grant EPA-R-804804-01)
(PB-288415/3; EPA-600/2-78-164) Avail: NTIS HC A07/MF A01 CSCL 13B

The generation of septage in rural areas essentially dictates that the treatment of this material be undertaken close to its point of origin to minimize treatment costs. Two strategies exist for its proper treatment. The utilization of local municipal wastewater treatment facilities as a receiver for this waste, or the construction of facilities exclusively for the handling of this material. This report defines the function, approaches, variables and problem areas associated with the raw septage receiving station, pretreatment (screening), septage conditioning, sludge dewatering, aqueous fraction treatment, sludge disposal, and combined fraction. GRA

N79-19936# Baltimore City Dept. of Planning, Md.
BALTIMORE CITY'S HUMAN SERVICES TRANSPORTATION: ANALYSIS AND RECOMMENDATIONS Final Report
Deborah C. Katz Nov. 1978 37 p Sponsored in part by Maryland DOT, Mayor's Office of Human Resources, Maryland, and Balt. Region Unified Transp. Planning Program, Maryland
(PB-288639/8) Avail: NTIS HC A03/MF A01 CSCL 13B

The eleven agencies with 30 divisions were providing services to handicapped and nonhandicapped children and adults, elderly persons, and infirmed residents. Trips were both individual and group. Trips were provided with 155 City-owned, donated, and shared vehicles and through various purchase of service arrangements. The following problems were found with the transportation system as it existed at the time of the study: under-utilization of city-controlled vehicles (hours of use per vehicle per week, miles traveled per day per vehicle, and percent passenger capacity utilized per vehicle per one-way trip); use of professional and para-professional staff as drivers; path duplication; minimal service provided to the physically handicapped; interruption of service when a vehicle was undergoing maintenance or repair; high administrative costs; duplication of administrative support staff across divisions; and overall high costs per passenger trip and per mile. GRA

N79-19937# American Univ., Washington, D. C. Inst. for Applied Public Financial Management.
MEASUREMENT OF EFFECTIVENESS OF A MAJOR POLICY CHANGE IN THE ADMINISTERING OF WATER AND WASTE DISPOSAL GRANT FUNDS Final Report
Charles B. Hart Jun. 1978 74 p
(PB-288550/7; AU/IAPFM-30-77-2) Avail: NTIS HC A04/MF A01 CSCL 13B

A study was developed to determine if the policy decision on administering water and waste disposal grants known as the

1 percent rule was effective. The 1 percent rule applies to a grant normally considered only when the debt service portion of the average user cost for either water or waste service exceeds 1 percent of the median income as determined by the 1970 Census. The grant will be limited to an amount necessary to reduce the debt service portion for each user to the 1 percent level. The study consisted of statistical random sampling of all grant projects for fiscal years 1972 through 1976. Computer programs were developed and run with the results given. GRA

N79-19938# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

TRAFFIC SURVEILLANCE DATA PROCESSING IN URBAN FREEWAY CORRIDORS USING KALMAN FILTER TECHNIQUES Final Report, Apr. 1975 - Apr. 1978

Paul K. Houpt, Michael Athans, Daniel G. Orlhac, and William J. Mitchell Nov. 1978 198 p refs
(Contract DOT-TSC-849)
(PB-288877/4; DOT-TSC-RSPA-78-18) Avail: NTIS HC A09/MF A01 CSCL 13B

Real-time surveillance of traffic conditions on urban freeway corridors using spatially discrete presence detectors is addressed. Using a finite-dimensional (macroscopic) fluid-analog model for freeway vehicular traffic flow, an extended Kalman filter is proposed as a data-processing algorithm to obtain minimum variance estimates of spatial mean speed and density. It is shown that certain model parameters associated with available roadway capacity can be estimated on-line with a variation of the extended Kalman filter, and furthermore, that the time signatures associated with these estimates provide quantitative information concerning the presence of anomalous (i.e., incident) traffic events. GRA

N79-19939# Vermont Univ., Burlington. Dept. of Agricultural and Resource Economics.

ECONOMIC ANALYSIS OF ALTERNATIVE SLUDGE DISPOSAL METHODS IN VERMONT Final Project Completion Report, 1 Oct. 1976 - 30 Sep. 1977

Richard G. Fritz Jun. 1978 110 p refs
(Contract DI-14-34-0001-7096)
(PB-288920/2; W79-01328; OWRT-A-031-VT(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

Information is provided on the costs of municipal sewage sludge disposal in Vermont. The costs of two methods of disposal, landfill and landspreading, factors which influenced disposal costs, the economic benefits of landspreading disposal, and a regional plan for sludge disposal are among the topics covered. An analysis of variance indicated, however, that per capita disposal costs associated with the use of flotation thickeners and vacuum filters were significantly higher than those associated with liquid and sand drying bed dewatered sludge disposal. Total costs of liquid sludge disposal were much more responsive to changes in distances to disposal sites than were total costs associated with dewatered sludge disposal. GRA

N79-19940# Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.

THE DEWATERING OF LIME-ALGAE SLUDGE ON SAND DRYING BEDS

Marvin T. Bond and Gayle F. Mitchell Sep. 1978 85 p refs
(Contract DI-14-34-0001-8026)
(PB-288941/8; W79-01349; OWRT-A-110-MISS(1)) Avail: NTIS HC A05/MF A01 CSCL 13B

A thickened lime-algae sludge was loaded at rates of 4.0 to 16.1 gal/sq ft to sand bed columns with media depths of 6 to 12 inches. A sludge cake with an average 25% solids content was obtained within ten hours at bed depths of 6 to 10 inches over the loadings applied, while 65 hours were required for a bed dept of 12 inches at loadings above 12 gal/sq ft. Investigations indicated that dewatering rate and effluent quality were not related to media size from 0.3 to 1.5 mm. Dewatering rates decreased with increasing solids loading from about 1 to 6 lbs/sq ft; however, effluent quality and sludge cake solids did not appear to be affected by solids loading. Dewatering rates above 1 gal/sq ft/hr were noted at a bed depth of 10 inches. Effluent suspended solids from the drying beds averaged 100 mg/1. GRA

N79-19941# Maryland Univ., College Park. Water Resources Research Center.

PROCEEDINGS OF A SYMPOSIUM ON LAND TREATMENT OF WASTE EFFLUENTS

1978 149 p Symp. held at the Center of Adult Education, Univ. of Maryland, College Park, 25-26 Apr. 1978
(PB-288926/9; TR-48; W79-01329; OWRT-A-9999-MD(14))
Avail: NTIS HC A07/MF A01 CSCL 02C

Results of research and case histories for systems of land treatment of waste effluent together with regulations or view-points of State and Federal regulatory and management agencies are presented. Participants had the opportunity to talk with equipment and instrumentation exhibitors who were also on the program to discuss applications of different types of distribution equipment and monitoring systems. Design criteria and the capabilities and limitation of soils to renovate water were discussed as was ecological impact. GRA

N79-19942# General Accounting Office, Washington, D. C. Community and Economic Development Div.

REUSE OF MUNICIPAL WASTEWATER AND DEVELOPMENT OF NEW TECHNOLOGY: EMPHASIS AND DIRECTION NEEDED

13 Nov. 1978 49 p refs
(PB-288884/0; CED-78-177) Avail: NTIS HC A03/MF A01 CSCL 13B

Several new or alternative wastewater treatment technologies exist which provide additional benefits to wastewater recycling and reuse. However, few techniques are used on construction grant projects because: they often provide unnecessary treatment levels, they are not cost effective in comparison to conventional secondary technologies; stringent State pretreatment requirements create additional costs; limited information on health effects exists; suitable land is not available; and program participants are unwilling to risk failure. The Environmental Protection Agency should encourage the acceptance and use of new or alternative technologies and designate a central group to analyze long-term wastewater treatment research needs. GRA

N79-19943# Wyoming Univ., Laramie. Dept. of Civil and Architectural Engineering.

OPERATION AND DESIGN OF EVAPOTRANSPIRATION WASTE DISPOSAL SYSTEMS

Victor R. Hasfurther and David H. Foster Aug. 1978 27 p refs Sponsored in part by the US Forest Service, Fort Collins, Colo.
(PB-289210/7; Eisenhower-Consortium-Bull-6) Avail: NTIS HC A03/MF A01 CSCL 13B

An evapotranspiration (ET) unit for disposal of wastewater was constructed and operated at Laramie, Wyoming, from August 1973 to September 1975. Results of the loading and wastewater treatment that occurred with the ET unit are presented. The results indicate that the use of evapotranspiration for treating wastewater from rural and mountain second homes during the warmer month of the year is feasible. The treatment of the wastewater by the ET unit through chemical and biological action is high and in many cases is within EPA standards for some uses of the water. An ET unit can be sized using standard evapotranspiration equations and examples of sizing are given. The ET unit is cost competitive with conventional systems for individual home sites, provides zero ground and surface water pollution, and is readily adaptable to most rural and mountainous areas. GRA

N79-19944# National Rural Center, Washington, D. C.

THE NATIONAL RURAL CENTER'S INFORMATION CLEARINGHOUSE; A REPORT ON ITS ACCOMPLISHMENTS AND ACTIVITIES, DECEMBER 1977 THROUGH SEPTEMBER 1978 Final Report

Sep. 1978 27 p
(Contract EDA-99-6-09521)
(PB-288895/6; EDA-78-0140) Avail: NTIS HC A03/MF A01 CSCL 05B

A report is given on the accomplishment and activities of the National Rural Center's Information Clearinghouse for December 1977 through September 1978. The report is an explanation of the structure, operations and programs of the Clearinghouse, which is a service of the National Rural Center.

The report reviews activities to increase outreach, intergovernmental and interorganizational programs, and comments briefly on future plans. GRA

N79-19945# Wisconsin Univ. - Milwaukee.
PROFESSIONAL ASSOCIATIONS AS INTERMEDIARIES IN TRANSFERRING TECHNOLOGY TO CITY GOVERNMENTS Final Report
Richard D. Bingham, Brett W. Hawkins, John P. Frendreis, and Mary P. LeBlanc Jun. 1978 422 p
(Grant NSF PRA-76-15750)
(PB-289332/9) Avail: NTIS HC A18/MF A01 CSCL 05A

The purpose of the study was to examine the role of public service professional associations in innovation transfer and to provide policy recommendations to improve the transfer of innovations via such groups. The objectives were met through a series of personal and telephone interviews with professional association staff members and city officials, through the analysis of city official responses to to a mailed questionnaire. GRA

N79-19946# Wisconsin Univ. - Milwaukee.
PROFESSIONAL ASSOCIATIONS AS INTERMEDIARIES IN TRANSFERRING TECHNOLOGY TO CITY GOVERNMENTS. EXECUTIVE SUMMARY Final Report
Richard D. Bingham Aug. 1978 30 p
(Grant NSF PRA-76-15750)
(PB-289333/7) Avail: NTIS HC A03/MF A01 CSCL 05A

The document contains the executive summary of the final report on a two-year study that examined the role of public service professional associations in innovation transfer. The report provides policy recommendations to improve the transfer of innovations via such groups. The objectives of the study were met through a series of personal and telephone interviews with professional association staff members and city officials, through visits to conventions and workshops, and through the analysis of city official responses to a mailed questionnaire. GRA

N79-19947# Industrial Innovation Coordinating Committee, Washington, D. C. Advisory Committee on Industrial Innovation.
DIRECT FEDERAL SUPPORT OF RESEARCH AND DEVELOPMENT: DRAFT REPORT
Dec. 1978 17 p
(PB-290407/6) Avail: NTIS HC A02/MF A01 CSCL 05A

The conclusions of the Panel on Direct Federal Support of Research and Development to stimulate innovation are presented. The panel identified three sectors from which one could expect a disproportionately accelerated rate of innovation provided that institutionalized mechanisms are created to provide the essential coupling between the generation of R&D and its utilization in new products, processes or test methods. These three sectors are respectively: the university environment, small venture businesses, and trade associations. The panel considered why each such sector lends itself to a boost in innovative capacity and proposes budgetary and institutional mechanisms to effect this. GRA

N79-19948# Industrial Innovation Coordinating Committee, Washington, D. C.
PUBLIC SYMPOSIUM ON DIRECT FEDERAL SUPPORT OF RESEARCH AND DEVELOPMENT
Jan. 1979 177 p Symp. held at Washington, D. C., 16 Jan. 1979
(PB-290408/4) Avail: NTIS HC A09/MF A01 CSCL 05A

Industrial innovation is discussed in terms of maintaining rapid industrial/economic growth, high productivity, and a competitive advantage in foreign markets. Emphasis is placed on the influence of direct Federal support of research and development. Social and economic factors are included. J.M.S.

N79-19949# Industrial Innovation Coordinating Committee, Washington, D. C. Advisory Committee on Industrial Innovation.
REGULATION OF INDUSTRY STRUCTURE AND COMPETITION: DRAFT REPORT
Dec. 1978 50 p refs
(PB-290409/2) Avail: NTIS HC A03/MF A01 CSCL 05A

In its study of the innovation climate in the U.S. and government's effect upon industry structure and competition, the subcommittee reached one over-riding conclusion. That is that the policies as well as the philosophy that today guide antitrust and regulatory practice must be rethought in light of a variety of new worldwide economic forces that now prevail and the less dominant role this country occupies on the economic stage. It is in these two important areas of government interaction with business -- regulation and antitrust -- where the most profound effects are present in the structural and competitive nature of American business and industry. GRA

N79-19950# Industrial Innovation Coordinating Committee, Washington, D. C.
PUBLIC SYMPOSIUM ON REGULATION OF INDUSTRY STRUCTURE AND COMPETITION
Jan. 1979 170 p Symp. held at Washington, D. C., 19 Jan. 1979
(PB-290410/0) Avail: NTIS HC A08/MF A01 CSCL 05A

The impact of government policies on innovation in the industrial sector is considered. Emphasis is on government regulatory processes and their affect on industry structure and competition. J.M.S.

N79-19951# Industrial Innovation Coordinating Committee, Washington, D. C. Advisory Committee on Industrial Innovation.
REVIEW AND RECOMMENDATIONS OF POLICY ALTERNATIVES OF THE PUBLIC INTEREST ADVISORY SUBCOMMITTEE: DRAFT REPORT
Dec. 1978 59 p refs
(PB-290411/8) Avail: NTIS HC A04/MF A01 CSCL 05A

Government policies that promote innovations of a type that will further the goals of our society and will fulfill the basic social and human needs of its citizens are considered. The Public Interest Subcommittee advocates the development of good, quantified social indicators. The Subcommittee also urges the improvement of economic indicators now in use, including indicators that would measure the many factors that affect productivity. GRA

N79-19952# Industrial Innovation Coordinating Committee, Washington, D. C.
PUBLIC SYMPOSIUM ON PROCUREMENT
Jan. 1979 186 p Symp. held at Washington, D. C., 15 Jan. 1979
(PB-290414/2) Avail: NTIS HC A09/MF A01 CSCL 05A

Government procurement policy is discussed in terms of enhancing innovation in the industrial sector. Patent policy and marketing are among the factors covered. Emphasis is placed on increased productivity through industrial innovation. J.M.S.

N79-19953# Industrial Innovation Coordinating Committee, Washington, D. C.
PUBLIC SYMPOSIUM ON ECONOMIC AND TRADE POLICY
Jan. 1979 191 p Symp. held at Washington, D. C., 22 Jan. 1979
(PB-290416/7) Avail: NTIS HC A09/MF A01 CSCL 05A

Factors that enhance industrial innovation in the United States are examined. The role of Federal policies, regulations, and programs on innovation in the industrial sector is emphasized. J.M.S.

N79-19954# Industrial Innovation Coordinating Committee, Washington, D. C.
FEDERAL PROCUREMENT POLICY: DRAFT REPORT
Dec. 1978 92 p refs
(PB-290417/5) Avail: NTIS HC A05/MF A01 CSCL 05A

The United States public and private enterprise combined is funding research and development at a slower rate than in past decades. Excessive taxes on capital gains and burdensome regulatory barriers have reduced investment incentives; organized opposition to technological change has further discouraged innovation. The long term consequences include lower productivity, high costs, inflation, unemployment, balance of payment problems, and a lower standard of living. Because it does have such great power over industry, the government can stimulate renewed investment in innovation through improved procurement practices,

stronger support of industrial research and development, and tax reform that removes penalties for entrepreneurial capital investment. GRA

N79-19955# Brussels Univ. (Belgium).
THE DYNAMICS OF URBAN EVOLUTION. VOLUME 1: INTER-URBAN EVOLUTION Final Report, May 1976 - Jun. 1977
P. M. Allen, J. L. Deneubourg, M. Sanglier, F. Boon, and A. dePalma Oct. 1978 85 p refs 2 Vol.
(Contract DOT-TSC-1185)
(PB-288957/4; DOT-TSC-RSPA-78-20-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 13B

The concept of 'order by fluctuation', that has appeared recently in physico-chemical and biological systems, is applied to the description of urban growth. It is shown that fluctuations play a vital role in the evolutionary process of urban growth. The evolution of a complex system cannot be known simply by studying deterministic equations describing the system. It is necessary, in addition, to study the effects of fluctuations, or historical accident, which can drive the system to new modes of behavior. Taking account of both the deterministic elements of urban growth and the appearance of innovations at chance locations in an economic region, a transportation-sensitive dynamic model of the evolution of the organization of urban centers was developed. GRA

N79-19956# Brussels Univ. (Belgium).
THE DYNAMICS OF URBAN EVOLUTION. VOLUME 2: INTRA-URBAN EVOLUTION Final Report, May 1976 - Jun. 1977
P. M. Allen, J. L. Deneubourg, M. Sanglier, F. Boon, and A dePalma Oct. 1978 139 p refs 2 Vol.
(Contract DOT-TSC-1185)
(PB-288958/2; DOT-TSC-RSPA-78-20-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 06F

A methodology capable of a multidisciplinary treatment of transportation planning was developed. The prediction of the consequences of modification in the transport system on the social, demographic, economic, and ecological structure of the total system was emphasized. J.M.S.

N79-19957# Design Alternatives, Inc., Washington, D. C.
PROCEEDINGS OF WORKSHOP ON APPROPRIATE TECHNOLOGY
Jan. 1978 360 p refs Workshop held at Washington, D. C., 23-25 Jan. 1978
(Contract NSF C-ERS-77-21824)
(PB-288897/2; NSF/RA-780182) Avail: NTIS HC A16/MF A01 CSCL 05A

A workshop was convened to enable people with interests or experience in appropriate technology to examine and document locally-focused issues in this field, and to contribute recommendations for a research agenda and program guidelines which could be considered in planning a distinct research program in appropriate technology. Issues to be examined were identified after review of concerns expressed by those who responded to a previous survey focused on local activities in appropriate technology, and after review of current or planned programs in different federal agencies. Six functional areas were chosen as subjects for examination: housing, local economic development, energy, waste disposal, health, and food. Participants documented local experience and concerns in the form of case studies and individually and collectively developed ideas through the workshops which were used to develop a research agenda and program guidelines. Using this information, the workshop convenor identified 27 basic research questions, and 10 high priority questions for the agenda. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-19958 State Univ. of New York at Stony Brook.
DEVELOPMENT OF A FABRY-PEROT INFRARED SPECTROMETER AND OBSERVATIONS OF MOLECULAR HYDROGEN IN THE ORION NEBULA Ph.D. Thesis
Erick Tom Young 1978 123 p
Avail: Univ. Microfilms Order No. 7905224

The development and performance of a Fabry-Perot spectrometer for astronomical observations in the infrared are described. The Cassegrain mounted instrument has a single stage, piezoelectrically scanned Fabry-Perot interferometer. It is shown that the Fabry-Perot interferometer is the preferred instrument if only a few spectral elements are of interest. The system is capable of detecting an emission line at 12.3 microns of flux 2 x 10 to the -18th power W/sq cm with a signal to noise ratio of 3/1 after an hour of integration at a 1.5 m telescope. Resolution is better than 1/cm in the 8-14 micron atmospheric window. A shock wave excitation model is developed to account for the H2 lines from the molecular cloud. Observations of molecular hydrogen lines from the Orion Nebula are considered as an application of the Fabry-Perot spectrometer. Dissert. Abstr.

N79-19959 Johns Hopkins Univ., Baltimore, Md.
ULTRAVIOLET OBSERVATIONS OF HOT STARS AND DIFFUSE NIGHTTIME LINE EMISSIONS Ph.D. Thesis
William Henry Brune, III 1978 114 p
Avail: Univ. Microfilms Order No. 7906435

Two rocket experiments were performed which were designed to measure the ultraviolet spectra of astrophysical objects with a high degree of photometric accuracy. Ultraviolet spectra from 3100 A to the hydrogen absorption edge at 912 A were obtained on 17 February 1977 by rocket observations above Woomera, Australia. Spectra taken at 15 A resolution were compared with the observed fluxes from OAO-2 and with recent model atmosphere calculations for five hot stars: gamma squared Vel, zeta Pup, alpha Eri, Beta Cen and alpha Vir. The present data give fluxes which are generally lower than those obtained from OAO-2, with the largest deviations of approximately 20% between 1400 and 1700 A. Effective temperatures are also determined. Dissert. Abstr.

N79-19960 Maryland Univ., College Park.
RADIO CONTINUUM INTERFEROMETRY OF DARK CLOUDS: A SEARCH FOR NEWLY FORMED HII REGIONS Ph.D. Thesis
William Steven Gilmore 1978 283 p
Avail: Univ. Microfilms Order No. 7906670

Eleven HII regions with associated visible emission and eighteen other possible HII region were detected. Comparison of the results of this survey with other investigations of HII regions and newly formed massive stars indcates that the radio continuum detectability of HII regions surrounding young massive cocoon stars is a function of the age and mass of the star. 09.5 ZAMS stars and earlier types may exhibit detectable radio continuum emission before the cocoon reaches the edge of a cloud and breaks up into a core/halo type of object. Computed dluxes and visibility functions for various models of HII regions indicate a range of HII regions for which this is possible. These computations also indicate the types of stars and HII regions that would and would not be detectable with the interferometer and/or the 300-foot telescope. Dissert. Abstr.

N79-19961 Johns Hopkins Univ., Baltimore, Md.
THE FAINT OBJECT TELESCOPE: A FIRST LOOK AT THE FAR ULTRAVIOLET SPECTRA OF EXTRAGALACTIC SOURCES Ph.D. Thesis
George Franklin Hartig, Jr. 1979 193 p
Avail: Univ. Microfilms Order No. 7906456

In response to the clear need for spectrophotometric measurement of faint extragalactic sources in the important far-ultraviolet (FUV) spectral region, a pioneering sounding rocket payload was developed and successfully used to observe, for the first time, the FUV spectra of a quasi-stellar object (QSO)

(3C 273) and a Seyfert galaxy (NGC 4151). This Faint Object Telescope payload employs a 40 cm diameter primary mirror, and a panoramic, photon counting, microchannel plate detector. A concave grating Rowland spectrograph simultaneously measures both the target and background spectra with moderate resolution. Telescope pointing is accomplished by means of a unique attitude control system. Fine pointing, to 5 arc second accuracy, is then achieved by means of a command system operated by the observer. Dissert. Abstr.

N79-19962*# Chicago Univ., Ill.
FAR INFRARED MAPS OF THE RIDGE BETWEEN OMC-1 AND OMC-2 Final Technical Report
Jocelyn Keene, J. Smith, D. A. Harper, R. H. Hildebrand, and S. E. Whitcomb Mar. 1979 19 p refs
(Grant NsG-2261)
(NASA-CR-158235) Avail: NTIS HC A02/MF A01 CSCL 03A

Dust continuum emission from a 6 ft x 20 ft region surrounding OMC-1 and OMC-2 were mapped at 55 and 125 microns with 4 ft resolution. The dominant features of the maps are a strong peak at OMC-1 and a ridge of lower surface brightness between OMC-1 and OMC-2. Along the ridge the infrared flux densities and the color temperature decreases smoothly from OMC-1 to OMC-2. OMC-1 is heated primarily by several optical and infrared stars situated within or just at the boundary of the cloud. At the region of minimum column density between OMC-1 and OMC-2 the nearby B0.5 V star NU Ori may contribute significantly to the dust heating. Near OMC-2 dust column densities are large enough so that, in addition to the OMC-2 infrared cluster, the nonlocal infrared sources associated with OMC-1 and NU Ori can contribute to the heating. G.Y.

N79-19963*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
THE 16-39 MICRON SPECTROSCOPY OF OXYGEN-RICH STARS
William J. Forrest, William J. McCarthy, and James R. Houck Feb. 1979 40 p refs
(Grants NGR-33-010-182)
(NASA-CR-158243; CRSR-717) Avail: NTIS HC A03/MF A01 CSCL 03A

Airborne observations of the 16-39 microns spectra of ten oxygen-rich stars with excess emission in the infrared was obtained. The stars show excess emission attributed to circumstellar dust grains in the 16-39 microns region in the form of a broad hump peaking near 18 microns and falling smoothly to longer wavelengths. The emission is similar in character to the emission from the Trapezium region of the Orion nebula indicating the grain materials are quite similar in these objects. The existence of a feature in the 20 microns region is consistent with the O-Si-O bending resonance expected for silicate material. The lack of any sharp structure in the spectra indicates the silicate is in an amorphous, disordered form. A simple model of small grains of carbonaceous chondrite silicate material in a diffuse circumstellar envelope is shown to give a good qualitative fit to the observed 8-39 microns circumstellar spectra. Comparison of the observed spectra with the model spectra indicates the grain emissivity falls as 1/lambda squared from 20 microns to 40 microns. L.S.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-19964 California Univ., Berkeley.
THE CORRELATION FUNCTION FOR DENSITY PERTURBATIONS IN AN EXPANDING UNIVERSE Ph.D. Thesis
John Albert McClelland 1978 228 p
Avail: Univ. Microfilms Order No. 7904531

Analytical solutions are derived for the evolution of linearized adiabatic spherical symmetric density perturbations and the two-point correlation function in two regimes of the early universe: the radiation-dominated regime prior to decoupling and the matter-dominated regime after decoupling. A formalism is developed to find the two-point and higher order correlation functions for a given distribution of sizes and shapes of perturbations which are randomly placed in three-dimensional space. Analytical models are developed to explain two-point and three-point correlation functions. The evolution of the two-point correlation function is calculated for the large scale distribution of galaxies in space from decoupling to present. Dissert. Abstr.

N79-19965 California Inst. of Tech., Pasadena.
TIDAL SYNCHRONIZATION OF THE ROTATION OF EARLY MAIN SEQUENCE STARS IN CLOSE BINARIES, 1. THE RINGS OF URANUS: RESULTS OF THE 1978 APRIL 10 OCCULTATION, 2. ON THE RESONANCE THEORY OF THE RINGS OF URANUS Ph.D. Thesis
Philip David Nicholson 1979 218 p
Avail: Univ. Microfilms Order No. 7906214

An investigation of the dynamical tide is presented which includes the heretofore neglected effects of stellar rotation. Observations of the 1978 April 10 stellar occultation by the rings of Uranus are presented. Nine rings were observed and their radii and widths are calculated. A three-body resonance model proposed to account for the rings of Uranus is quantitatively analyzed and found to be unacceptable on several grounds. Dissert. Abstr.

N79-19966 Wisconsin Univ. - Madison.
OBSERVATIONAL CONSTRAINTS ON THE ORIGIN OF THE DIFFUSE BACKGROUND RADIATION BETWEEN 0.5 AND 2 keV Ph.D. Thesis
John Andrew Nousek 1978 213 p
Avail: Univ. Microfilms Order No. 7822265

The spatial and spectral nature of the diffuse soft X-ray background were studied using data from five sounding rocket flights. The spectrum of the high (2-6 keV) X-rays is consistent with 11E to the -1.4 power photons (1/s2q cm -ser-sr-keV) to the -1 power, and is in agreement with the observations of others. The data at intermediate energies (0/5-2.0 keV) are found to admit the possibility of a constribution of extragalactic origin at least as large as the extrapolation of the higher spectrum. The conclusion that emitting regions with two differing temperatures are required to explain the soft X-ray background is supported. Variable models as to the nature and location of the higher temperature emitting regions are discussed.Dissert. Abstr.

N79-19967 Arizona State Univ., Tempe.
STUDIES OF ABSORPTION LINES IN THE SPECTRA OF QUASI-STELLAR OBJECTS Ph.D. Thesis
Bradley Michael Peterson 1978 130 p
Avail: Univ. Microfilms Order No. 7904982

The possibility that the narrow-line absorption spectra of QSOs arise in foreground galaxies or in other intervening material is examined. Attention is focused on low-redship absorption systems for the purposes of minimizing (1) redshift-dependent selection effects, (2) the effect of neglecting possible evolution, and (3) the problem of ambiguous line indentification. Near the emission redshift, the distribution of the low-ionization-level systems observed at low-redshift differs markedly from that of high-ionization-level systems observed in the spectra of high-redshift QSOs. It seems likely that this difference at least in part reflects fundamentally different origins of these two types of systems. Dissert. Abstr.

N79-19968 California Univ., Berkeley.
OBSERVATIONS OF THE LOWEST TWO ROTATIONAL TRANSITIONS OF CARBON MONOXIDE IN INTERSTELLAR MOLECULAR CLOUDS Ph.D. Thesis
Richard Louis Plambeck 1978 187 p
Avail: Univ. Microfilms Order No. 7904579

Observations of emission line spectra of the J=2 to 1 and J=1 to 0 rotational transitions of carbon monoxide, at frequencies near 230 GHz and 115 GHz, are used to study the physical conditions within interstellar molecular clouds. The radio receiver used for these observations, as well as the techniques by which the atmospheric attenuation and antenna beam efficiency were measured, are described in detail. From an analysis of the J=2 to 1 and J=1 to 0 (12) C (16) O spectra for about 20 sources, and of the J=2 to 1 and J=1 to 0 (13) C (16) O and (12) C (18) O spectra for some of these sources, it is concluded that

in most of these molecular clouds (1) large-scale gas motion, and not microturbulence, is the primary line-broadening mechanism; (2) average molecular hydrogen densities range between 2000 and 8000 cm to the -3 power; and (3) the fractional abundance of 13 CO relative to H2 is about .000001. In addition, there is evidence that CO line wings originate from regions of the clouds with especially high hydrogen densities and high velcoity gradients. Dissert. Abstr.

N79-19969 Princeton Univ., N. J.
THE DYNAMICS OF GALAXY CLUSTERING: ANALYSIS AND SIMULATION OF THE VIRIALIZED COMPONENT Ph.D. Thesis
Raymond M. Soneira 1978 207 p
Avail: Univ. Microfilms Order No. 7905644

Velocity and spatial correlation functions are used to measure observables of clustering as a whole so that it is not necessary to decide on an individual basis which galaxies are grouped together in space. The model simulations of Soniera and Peebles are extensively compared to the real universe. It is shown that (1) there are very large systematic errors involved in the traditional method of applying the Virial Theorem using groups of galaxies, (2) on the average, clustered galaxies are stable associations in virial equilibrium for scales extending out to a at least 7 h/1 Mpc (h is Hubble's constant in units of 100 km/sec/Mpc); and (3) there is evidence that on galactic scales, gravity is an inverse square-law force and that almost all matter is spatially distributed like galaxies in a clustering hierarchy on scales approximately less than 7h/1 Mpc. Dissert. Abstr.

N79-19970 California Univ., Berkeley.
RADIATIVE TIDES IN ACCRETION DISKS Ph.D. Thesis
Stephan Vance Weber 1978 136 p
Avail: Univ. Microfilms Order No. 7904842

Accretion disks are found in binary star systems undergoing mass transfer. An attempt is made to avoid the difficulties of the viscous disk model by investigating two accretion processes not requiring viscosity. The principal process under investigation is radiative tides. The tidal field of the companion perturbs the orbits in the disk so that the gas is compressed and expanded as it orbits. Radiative losses make the response of the gas nonadriabatic, and consequently out of phase with the driving potential. This gives rise to a torque on the disk, which causes accretion. A second process which is considered is accretion caused by the impact of the accretion stream, which propagates radially in the disk. Dissert. Abstr.

N79-19971 Maryland Univ., College Park.
FUNDAMENTAL PROPERTIES OF EQUILIBRIUM STELLAR MODELS Ph.D. Thesis
Lee Arlow Lindblom 1978 187 p
Avail: Univ. Microfilms Order No. 7906659

The final equilibrium states of stars which result from the completion of the thermonuclear evolution process are discussed. The stellar models, based on the Newtonian and the general relativistic theories of gravitation, are analyzed to determine what predictions they make about the properties of the final equilibrium configurations of stars. Because it is very difficult to solve the equations of stellar structure (especially when the angular momentum is non-zero), the equations themselves are analyzed to determine general properties which any particular solution to a stellar model must posses. The equations of thermodynamics, fluid mechanics and gravitation are presented for both theories. The concepts of thermodynamic equilibrium and stationarity (time independence) of the stellar models computed from these theories are defined and discussed. The relationships between stationarity and thermodynamic equilibrium are derived. Dissert. Abstr.

N79-19972*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
GALACTIC CIVILIZATIONS: POPULATION DYNAMICS AND INTERSTELLAR DIFFUSION
William I. Newman and Carl Sagan Dec. 1978 90 p refs
(Grant NGR-33-010-101)
(NASA-CR-158245; CRSR-711) Avail: NTIS HC A05/MF A01 CSCL 03B

The interstellar diffusion of galactic civilizations is reexamined by potential theory; both numerical and analytical solutions are derived for the nonlinear partial differential equations which specify a range of relevant models, drawn from blast wave physics, soil science, and, especially, population biology. An essential feature of these models is that, for all civilizations, population growth must be limited by the carrying capacity of the environment. Dispersal is fundamentally a diffusion process; a density-dependent diffusivity describes interstellar emigration. Two models are considered: the first describing zero population growth (ZPG), and the second which also includes local growth and saturation of a planetary population, and for which an asymptotic traveling wave solution is found. G.Y.

N79-19973# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
IMPROVED TWO-MICRON CELESTIAL BACKGROUND ESTIMATES
David Leisawitz and Jerry Krassner Mar. 1979 26 p refs
(RM-682) Avail: NTIS HC A03/MF A01

A galactic model is described that is used to predict contributions to the 2.2 micron background resulting from various classes of celestial objects. Initially, this model is fit to the Caltech Two-Micron Sky Survey to extrapolate to fluxes below the survey completeness level. Contributions to the 2.2 micron background due to main sequence stars and external galaxies are shown to be significant at faint fluxes and are included in the model. Extinction from interstellar dust grains is also included and exhibits a considerable effect on the background at these fluxes. Suggestions are also made for future work. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-19974 California Univ., Los Angeles.
EFFECTS OF ACCRETION ON THE INERTIAL THERMAL STATE OF THE MOON Ph.D. Thesis
Gary Allan Ransford 1978 197 p
Avail: Univ. Microfilms Order No. 7906193

Representative accretionary bombardments are constructed for the Moon by randomly sampling the mass and velocity distributions for objects in the solar nebula in circumsolar and circumterrestrial orbits. The lateral heterogeneities that characterize real accretion processes are presented. The average melt percentage results show substantial deep melting, but the spread of melt percentage values about the mean from the random sampling procedure is wide enough to include 0% melting for radii up to 1000 km, and 100% melting for radii below 500 km. The sensitivity of the results of these computations to reasonable variations in the solar nebula description parameters and the geophysical parameters describing the response of the Moon to impact events are investigated. Dissert. Abstr.

N79-19975 California Univ., Los Angeles.
THE DIFFERENTIATION HISTORY OF SMALL BODIES IN THE SOLAR SYSTEM: THE HOWARDITE AND MESOSIDERITE METEORITE PAREN BODIES Ph.D. Thesis
David Wayne Mittlefehldt 1978 223 p
Avail: Univ. Microfilms Order No. 7906183

Mesosiderites and howardites are regolith samples of differentiated asteroids. They appear to be related to the diogenites, eucrites, pallasites, 3AB irons and possibly the unique achondrite, Angra dos Reis. These groups comprise approximately half of the known differentiated, silicate-rich meteorite groups. Dissert. Abstr.

N79-19976 Maryland Univ., College Park.
VERY LONG BASELINE INTERFEROMETRY APPLIED TO POLAR MOTION, RELATIVITY, AND GEODESY Ph.D. Thesis
Chopo Ma 1978 386 p

Avail: Univ. Microfilms Order No. 7905484

The causes and effects of diurnal polar motion are described. An algorithm is developed for modeling the effects on very long baseline interferometry observables. Five years of radio-frequency very long baseline interferometry data from stations in Massachusetts, California, and Sweden are analyzed for diurnal polar motion. Simulations of high precision very long baseline interferometry experiments, taking into account both measurement uncertainty and modeled errors are described. It is found that the Wide-Band Optical Very Long Baseline Interferometer may be useful in studying gravitational deflection near Jupiter. The effects of scheduling and the number of sources observed on estimated baseline errors are discussed. New hardware and software techniques in very long baseline interferometry are described. Dissert. Abstr.

N79-19977 California Univ., Los Angeles.
PHYSICAL AND DYNAMICAL EVOLUTION OF LONG-PERIOD COMETS Ph.D. Thesis
Paul Robert Weissman 1978 265 p
Avail: Univ. Microfilms Order No. 7906204

A Monte Carlo simuation model was constructed to mimic the physical and dynamic evolution of long-period comets from the Oort cloud. The computer program includes models for perturbations by the the major planets, non gravitational forces, and passing stars, and physical loss due to collision with planets or asteroids, loss of all volatiles, and random disruption events. It is shown that only an Oort cloud hypothesis can explain the observed distribution of original inverse semi-major axes for the long-period comets. The evolution of the orbits tends to be dominated by planetary perturbations after the initial perihelion passage from the Oort cloud. Dissert. Abstr.

N79-19978 California Inst. of Tech., Pasadena.
THE ROTATION OF VENUS. PART 1: ATMOSPHERIC TIDES. PART 2: OBLIQUITY AND EVOLUTION Ph.D. Thesis
Anthony Robert Dobrovolskis 1979 263 p
Avail: Univ. Microfilms Order No. 7906208

Earth-based radar-observations reveal that the surface of Venus rotates very slowly in the retrograde sense. Tides raised by the sun in the body of Venus tend to slow its rotation further. The spin of Venus might be in a steady state if thermal tides in the atmosphere balance the tidal torque on the crust. Part 1 of this dissertation presents a quantitative theory of atmospheric tides applicable to Venus. It is found that the thermal tide is capable of maintaining the rotation of Venus in its current state indefinitely. Part 2 examines the effects of obliquity, the frequency-dependence of the tides, core-mantle coupling, possible resonances, and other phenomena. It appears most likely that Venus originated with an obliquity greater than 90 deg.
Dissert. Abstr.

N79-19979*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
SIGNIFICANCE OF SHOCK AND BODY SLIP CONDITIONS ON JOVIAN ENTRY HEATING Progress Report, Aug. 1978 - Dec. 1978
S. N. Tiwari and K. Y. Szema Jan. 1979 53 p refs
(Grant NsG-1492)
Avail: NTIS HC A04/MF A01 CSCL 03B

The influence of the body and shock slip conditions on the heating of a Jovian entry body is investigated. The flow in the shock layer is considered to be axisymmetric, steady, laminar, viscous, and in chemical equilibrium. Realistic thermophysical and step-function spectral models are employed and results are obtained by implicit finite-difference and iteractive procedures. The freestream conditions correspond to a typical Jovian entry trajectory point. The results indicate that the effect of the slip conditions is significant when the altitudes are higher than 225 km and that the contribution of a radiative heat-flux term in the energy equation should not be neglected at any altitude.
Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-19980# California Univ., San Diego, La Jolla.
THE LATITUDINAL STRUCTURE OF SOLAR WIND FROM RADIO SCINTILLATION OBSERVATIONS
J. J. Kaufman 2 Jun. 1978 19 p
(Contract F19628-77-C-0161; AF Proj. 2311)
(AD-A061454; AFGL-TR-78-0169; Scientific-1) Avail: NTIS HC A02/MF A01 CSCL 03/2

The relation between the solar corona and high-speed solar wind measured from interplanetary scintillations (IPS) are investigated. Preliminary results show that regions of high coronal intensity of the 5303 A Fe XIV green line are associated with low IPS velocities, whereas regions of low intensity are associated with both low and high velocities. There is some indication at high heliographic latitudes that the IPS velocity is inversely correlated with the angular divergence of the coronal magnetic field. A new model for the turbulence profile in a solar wind stream, is presented which will be used to refine this interpretation of IPS data. Author (GRA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-19981 Stanford Univ., Calif.
THE INTERACTION OF X-RAYS WITH THE INTERSTELLAR MEDIUM Ph.D. Thesis
Sally Kristen Ride 1978 117 p
Avail: Univ. Microfilms Order No. 7905917

The models developed used to compute the photoabsorption cross-section of the interstellar medium in the direction of the Crab Nebula. This cross-section is employed to reanalyze the soft X-ray data acquired by the Copernicus satellite. The resulting value of the total hydrogen column density, when interpreted in the context of the interstellar model, is fully consistent with ultraviolet and radio observations. Interstellar absorption and scattering obscure and disguise the soft X-ray spectra of cosmic sources; however, the features introduced into the the spectra are potentially valuable probes of the structure and dynamics of the interstellar medium. Dissert. Abstr.

N79-19982 California Univ., Berkeley.
STUDIES OF THE EXTREME ULTRAVIOLET/SOFT X-RAY BACKGROUND Ph.D. Thesis
Robert Allan Stern 1978 126 p
Avail: Univ. Microfilms Order No. 7904612

With a primary field-of-view of 2.3 plus or minus 0.1 deg FWHM and four EUV bandpass filters (16-25, 20-73, 80-108, and 80-250 eV) a focusing telescope made an extensive sky survey of the extreme ultraviolet (EUV)/soft X-ray background as part of the Apollo-Soyuz mission. Analysis of the data reveals an intense flux above 80 eV energy, with upper limits to the background intensity given for the lower energy filters (approximately 20,000 and 600 ph/sq cm/sec/ster/eV at 21 and 45 eV respectively). The uniformity of the background flux is uncertain due to limitations in the statistical accuracy of the data. Severe constraints are placed on models for the origin of the EUV background based upon various classes of unresolved point sources, increasing the likelihood that the EUV/soft X-ray background is probably the result of emission from hot plasma in the interstellar medium. Dissert. Abstr.

99 GENERAL

N79-19983# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 61

13 Mar. 1979 53 p refs Transl. into ENGLISH from various Russian and Hungarian journals

(JPRS-72988) Copyright. Avail: NTIS HC A04/MF A01

The increasing use of automatic control in Soviet industries and for urban transportation systems is reported as well as the development of a multiplexer for data transmission. Various applications of lasers in science and industry are described. Optical-mechanical scanners developed for environmental monitoring are discussed. The effects of long term weightlessness on the human body are assessed. For individual titles, see N79-19984 through N79-19987.

N79-19984# Joint Publications Research Service, Arlington, Va.

PROTOTYPE OF DATA TRANSFER MULTIPLEXER TESTED IN USSR **c60**

In its Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 61 (JPRS-72988) 13 Mar. 1979 p 5-9 Transl. into ENGLISH from Szamitastechnika (Budapest), 8 Dec. 1978 p 4 (For primary document see N79-19983 10-99)

Avail: NTIS HC A04/MF A01

With completion of the prototype of the TMX-2410 data transfer multiplexer, the establishment of total data teleprocessing subsystems became possible. Following factory testing, additional testings demonstrated its functioning on real communication channels by running typical user programs, as well as terminal testing programs prepared by the developers. A.R.H.

N79-19985# Joint Publications Research Service, Arlington, Va.

PROBLEMS OF HUMAN ADAPTION TO SPACEFLIGHT **c52**

O. G. Gazenko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 61 (JPRS-72988) 13 Mar. 1979 p 23-30 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 1, 1979 p 17-21 (For primary document see N79-19983 10-99) Copyright. Avail: NTIS HC A04/MF A01

Data obtained from manned space flights shows that space flight conditions and factors change the physiological state of the human body. However, these changes are of an adaptive character, and, for the time being, there is no serious basis for regarding them as disease processes. The adaptive process has several stages and evidently the establishment of a new, relatively stable functional level is achieved within 1 to 1.5 months from the onset of flight. In adapting to space conditions, the body uses its reserve capabilities and restructures its functions. The principal effects of weightlessness on physiological functions are caused by a change in the sensing sphere of man, absence of hydrostatic blood pressure, and the absence of a weight load on the muscles and skeletons. Means must be developed for safeguarding health by eliminating the deconditioning of the cardiovascular system, orthostatic instability, functional atrophy of the muscles, negative calcium balance, and general weakness. Possible genetic effects of prolonged space flights will be of a random, rather than a cosmic nature. A.R.H.

N79-19986# Joint Publications Research Service, Arlington, Va.

OPTICAL-MECHANICAL SCANNERS FOR EARTH OBSERVATION **c43**

A. S. Selivanov, V. P. Chemodanov, B. A. Suvorov, M. K. Narayeva, I. F. Sinelnikova, R. S. Bondarenko, and V. I. Seregin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 61 (JPRS-72988) 13 Mar. 1979 p 31-39 refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), no. 6, 1978 p 17-21 (For primary document see N79-19983 10-99)

Avail: NTIS HC A04/MF A01

The main information sources in the radio-television complex of the Meteor experimental satellites intended primarily for observation of the earth's surface, are the low-resolution (MSU-M) and medium-resolution (MSU-S) multichannel scanners. These transmit images from the visible and near IR ranges with a terrain resolution on the order of a kilometer (MSU-M) or hundreds of meters (MSU-S). In terms of their operation, these scanners are optomechanical systems with single-line scanning and single-element detectors, whose frame scanning is effected by the movement of the satellite. The MSU-M operates in four spectral ranges and the MSU-S in two. A radio link simultaneously transmits signals from the MSU-M's four channels and from one channel (selectable) of the MSU-S. Two channels may be transmitted simultaneously for the MSU-S by switching the video signal from line to line, with resultant decreased frame resolution. A.R.H.

N79-19987# Joint Publications Research Service, Arlington, Va.

LASER APPLICATIONS REVIEWED, IMPORTANCE STRESSED **c36**

F. Bunkin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 61 (JPRS-72988) 13 Mar. 1979 p 40-44 Transl. into ENGLISH from Izvestiya (Moscow), 30 Jan. 1979 p 3 (For primary document see N79-19983 10-99)

Avail: NTIS HC A04/MF A01

The use of continuous and pulsed modes of coherent optical radiation in the visible and invisible wavelengths provides extensive opportunities in both science and industry. In addition to optical radar, progress is reported in applying laser emission properties in controlled thermonuclear synthesis, isotope separation, molecular biology, biochemistry, and in microsurgery for the treatment of glaucoma. Technological applications include the drilling of diamonds and other jewels used in timepieces, the fabrication of microcircuits, cutting fabrics, and the cutting, welding, and hardening of metals. A.R.H.

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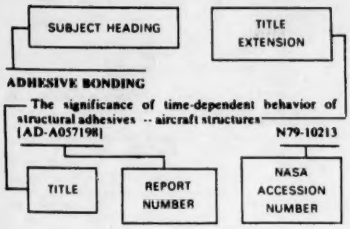

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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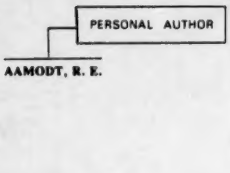

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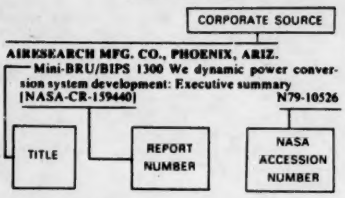

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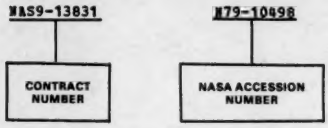

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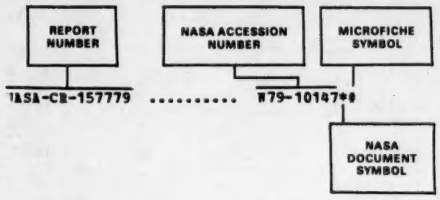

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